Photo by H. F. Macmillan.

AMOMUM MELEGUETA.

Grains of Paradise.

Grains of Paradise. Guinea Grains, or Melegueta Pepper (*Amomum Melegueta.* N. O. Scitamineæ).—A herbaceous bushy perennial, 4 to 5 ft. high, native of West Tropical Africa, and belonging to the Ginger and Cardamom family. The small dark aromatic seeds are imported from the Gold Coast into Europe, where they are used chiefly in cattle medicine, for flavouring cordials, and for imparting an artificial strength to spirits, wine and beer. In Africa they are largely used by the natives to season food, and are considered very wholesome. It is said that about 1,000 cwt. of this spice is imported annually into England, and sold for 80s. to 90s. per cwt. The plant has been introduced at Peradeniya in 1867, and is found to thrive here in ordinary soil and partial shade.—H. F. M.

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PROGRESS IN CEYLON AGRICULTURE.

So long as the agriculturist remains at the primitive stage of agriculture which we have described elsewhere as "grow what you want, and consume what you grow," he is practically independent of the general progress of the world; he shuts himself out from it. Were there no other people in the country, it might just as well be non-existent, and would not be missed if carried away by a volcanic eruption. It does not alter the general position that some of the things the cultivator may require, *e.g.*, his clothes or his furniture, are made by the artisans employed by the village and paid by a levy on the crops of that village. So long as this system goes on, and the man does not have to go outside the village to get what he wants, so long is he practically independent of the outside world.

Such a position of native agriculture may be, and in the past often has been, regarded as an ideal, and there is something to be said for it, for so long as it holds, the agriculturist is independent of fluctuations in the market value of crops that he grows, and is independent of other peoples' improvement in the production of those crops.

But for good or evil, the policy of the various tropical Governments has always been against this ideal. Not only have they made efforts to improve the actual agriculture of the natives, but—and this is of far greater importance—they have made roads all over the country, an absolutely unnecessary luxury if the simple ideal is to be followed. And they have provided education, another entirely unnecessary thing. In these and other ways, the Governments have done much to break up the old primitive simplicity. Let it be noted that so long as agriculture in the country works upon such lines, so long there can be little exportable value, and consequently there can be little to tax, so that the Government must be content with a small revenue and a small establishment. On the other hand, of course, there need be no expenditure upon public works, railways, education and other things. A country in such a state is of no importance to the world at large at the present time.

In actual fact there is in most Eastern countries sufficient local capitalism to interfere to some extent with the following of this ideal, but it must be clearly understood that till the development of transport facilities, and still more the introduction of foreign labour into those countries where labour was not easily procurable, it could not develope upon any large scale. Until that stage was reached, it could only reap its interest in a tax on the crops of the villagers, who paid say 50% of the crop for the

rent of the land. In this way, therefore, local capitalism practically corresponded to lending as done to day by the money-lenders, seed-lenders, and others.

With the "opening up" of the country of Ceylon by roads, and by the introduction of cheap labour from the overcrowded districts of Madras, capitalist agriculture, strictly so-called, became possible. Local capitalists rarely took any hand in the development which went on, and the great coffee, cinchona, tea, cacao, cardamom and rubber industries were successively opened by European capitalists, until now a large part of the island is in their hands, and their industries provide a very large part of the revenue which has enabled the Government to do so much for the island generally.

The ideal state for the colony would doubtless be that all these industries should be in native hands, so that the revenue brought in by them should not go abroad, but should enrich the colony. But as things are, it is too late for this to be the case, and the white planter has come, and apparently to stay. All then that can be done is to encourage the growth of a native capitalist industry beside the European, and if this prove sufficiently prosperous, the latter may conceivably at some far distant period be brought out by slow degrees.

But unless something is done to help the ordinary village agriculturist, he must in general remain where he is, and the only native capitalists to arise will be those who are now in possession of some money, or who come into possession of it in some other way than by agriculture. It is all but impossible for the villager to become possessed of any serious amount of money under the present system. Co-operation is urgently called for, and after some years of thorough trial, we may look to see a fair number of villagers freed from the necessity of borrowing, and may even hope to see a few of them rise in time to the possession of considerable money of their own, and the development of capitalist industry. The great thing is to get the villager clear of debt.

Matters have so far progressed, with the opening up of the country, that the villager now wants to buy things which cannot be produced within the village, *e.g.*, kerosene oil, or Manchester goods. But to buy he must sell, and is thus drawn into the world-wide vortex of buying and selling. If he does not improve, the quality of his produce will become steadily poorer by comparison with that of other folk, and he will get less for it. When once he begins buying outside his village, the villager must improve, or be left behind, and consequently deteriorate.

Now so long as he is uncombined, so long is his security poor, and so long must he pay high interest, so that, as elsewhere explained, he cannot in general adopt improvements, which will not usually return enough to pay interest on his loan.

But let him *combine*, and an entirely different story may be told. He can borrow money more cheaply, he can buy manure, seed, or complex tools more cheaply, he can sell more cheaply and to greater profit, and in many other ways he can get a better footing on the ladder of progress.

If the villagers be combined in matters of money, supply of seed, manure, &c., and sale of produce, each combination becomes (in a short time at any rate) practically a capitalist on its own account, and is no longer helpless before other capitalists or combinations of capital.

If once this fact could be realised in Ceylon, and properly acted upon, we should see the villager a great stage forward upon the road of agricultural progress. He would practically have caught up with the leeway of recent years.

There is, of course, another way in which he can get money without heavy interest, but this means going to work on capitalist estates, and very often he has not the time available without working much harder than previously—a thing he does not pine for—or neglecting his own cultivations. It is better to help him to help himself in his own agriculture, though also very desirable that he should earn money by regular paid labour.

The Java system, under which the villager gives a certain daily proportion of his time to regular estate work, is very good.

In one way or another, the next step for the Ceylon villager is to get as far as possible out of debt, and then one may look for some agricultural progress, but till that happens, such progress is all but hopeless except to the capitalist, large or small. If the solution adopted be that of estate work, progress in agriculture proper will be small, and local.

J. C. W.

GUMS, RESINS, SAPS AND EXUDATIONS.

THE SCIENCE AND PRACTICE OF PARA RUBBER CULTIVATION.

By John Parkin, M.A., F.L.S.

(From *Science Progress*, No. 15, January, 1910.)

(*Continued from p. 296.*)

Part II.

The Extraction of the Latex.

The procedure employed in the East for the extraction of the latex from the stems of cultivated Hevea trees was elaborated independently, and not influenced by the native method still used in the forests of the Amazon.

The late Dr. Trimen in 1888 commenced tapping experiments at Heneratgoda in Ceylon on the rubber trees which had grown from the seedlings received from Kew in 1876. Vertical rows of V-shaped incisions were made in the bark of the trunk, from a height of six feet downwards, with a mallet and carpenter's chisel. The incisions were placed about a foot apart vertically, and the rows at a like distance horizontally. The latex oozing out of these cuts was made to trickle down the surface of the bark in a series of streams corresponding to the number of vertical rows of incisions. The whole of the milk was caught at the base by a clay gutter moulded round the trunk, and directed into one or more coconut shells placed around the foot of the tree. A second tapping was performed in a similar manner, the new incisions being inserted between the old ones, and so for subsequent bleedings. For details of this somewhat crude method, now almost obsolete, the reader is referred to one of the circulars published by the Ceylon Botanic Gardens Department.*

Dr. Willis continued the tapping experiments initiated by his predecessor, employing the same method. His results with respect to yield of rubber per single tapping brought out the remarkable fact that the second tapping gives a considerably larger quantity of caoutchouc than the first. Since his figures gave the first indication of the now well-known "wound-response," it may be of interest to quote his remarks and figures from the circular† already referred to:—

"The tappings may follow one another at intervals of a week for about four to eight weeks. The second tapping gives a much larger yield than the first, and the third and fourth tappings are usually very productive. In a series of experiments made during 1897 on trees of about two feet mean girth, the average yield per tree of the successive weekly tappings was as follows:—

	oz.
First week	·73
Second week	1·48
Third week	·97
Fourth week	·80
Fifth week	·67
Sixth week	·52
Total	5·17"

Willis, realising that the methods he was then using for the extraction and preparation of the rubber were probably capable of much improvement, set the writer (who had just been appointed his scientific assistant) to work on these matters. The main outcome of this investigation,* carried out in Ceylon at both Peradeniya and Heneratgoda in 1898-99, consisted in the demonstration of "wound-response" and the introduction of an easy means of preparing rubber of high quality and purity from the latex. The subject of preparation is treated of in the next section of this paper. Our attention must now be turned to the phenomenon of wound response.

Wound-response.—On general grounds it might be assumed that the trunk of a rubber tree would have yielded most of its store of latex after a single extensive tapping, so that none, or very little, would be forthcoming from a second tapping within a few days. This is practically what happens in the case of *Castilloa elastica*.

On the other hand, taking into account Willis's results, which show about double the weight of rubber from the second tapping, it might be conjectured that the injuries (incisions) stimulated in some way the accumulation of latex, so that a greater flow would issue from a similar number of incisions made a few days later. This, in fact, is how Hevea behaves.

Several simple experiments soon proved this. One was conducted in this wise. A piece of bark about an inch square was removed from certain Hevea trunks.

* Willis, Circular, Royal Botanic Gardens, Ceylon, 1898, No. 4, Series I. 30,31

† Willis, Circular, Royal Botanic Gardens, Ceylon, 1898, No. 4, Series I. p. 32

* J. Parkin, Circular, Royal Botanic Gardens, Ceylon, 1899, Nos. 12, 13, 14, Series I.

After the lapse of two days, incisions were made near the wound and also on parts of the trunk at the same level farthest away from, *i.e.*, opposite, the injury. Fully double the quantity of latex was obtained from the cuts near the wound, as compared with that yielded by those incisions made opposite.

Attention was then directed to the time-interval necessary in order to render this response recognisable. After twelve hours no difference was observed between the volume of latex yielded by the two classes of incisions. Sometimes after twenty-four hours and generally after two days, the effect of wounding on the yield, however, was marked. Apparently the drier the soil the longer the time required for the response to appear. The experience of planters and others since has shown that two days is, as a rule, the best interval between successive tappings, but some estates tap every day with good returns.

The following table gives in concise form the results of a somewhat elaborate experiment conducted at Peradeniya from March to June, 1899.* Four trees were employed, and a horizontal row of ten similar incisions made per tree per tapping. Each fresh row of incisions was made near those of the preceding tapping, in order that the wound-response might take effect. The interval between tappings was usually five days. A less allowance would most likely have made the experiment still more striking.

	Volume of latex in cubic centimeters.		Volume of Latex in cubic cent.
1st tapping ...	61.0	8th tapping ...	253·0
2nd ,, ...	105·5	9th ,, ...	246·5
3rd ,, ...	220·0	10th ,, ..	275·0
4th ,, ..	208·5	11th ,, ...	255·0
5th ,, ...	255·5	12th ,, ...	262·0
6th ,, ..	290·0	13th ,, ...	328·0
7th ,, ..	276·0	14th ,, ...	449·0

This experiment brought out the effect of wounding on the flow of latex in a still more favourable light; and considering that at the fourteenth tapping, when the experiment had to be brought to a conclusion, the volume was the largest collected, it would appear that the limit to the full advantage to be gained from wound-response had not yet been reached.

From a practical point of view this experiment is defective in that no estimations were made as to the percentage of caoutchouc in the latex from the successive tappings. A large flow might mean a thin milk, yielding little solid rubber. Stanley Arden's work in the Malay States has supplied in some measure the deficiency. His results, published in 1902, have proved that the weight of caoutchouc itself is increased by the wound-response, and this increment is maintained or further augmented for a number of tappings. The following figures referred to one of his experiments, in which ten trees were tapped every day for a fortnight.

	Wet rubber. in oz.		Wet rubber. in oz.
1st tapping ...	$6\frac{1}{4}$	8th tapping ...	$31\frac{5}{8}$
2nd ,, ...	$11\frac{3}{4}$	9th ,, ...	29
3rd ,, ...	$17\frac{1}{2}$	10th ,, ...	$30\frac{3}{8}$
4th ,, ...	$23\frac{3}{8}$	11th ,, ...	$31\frac{1}{4}$
5th ,, ...	$26\frac{3}{8}$	12th , ...	$29\frac{3}{8}$
6th ,, ...	$26\frac{3}{4}$	13th ,, ...	$30\frac{3}{8}$
7th , ..	$23\frac{7}{8}$	14th ,, ...	$33\frac{3}{4}$

Here, as in the Ceylon experiment, the yield per tapping has been well maintained throughout; and at the fourteenth and last tapping instead of any diminution in yield, there is a slight increase, showing that the experiment could have been continued longer with profitable results.

The demonstration of wound-response, therefore, placed Hevea in a much more favourable position as a rubber producer, stimulating its cultivation. Before the discovery of this peculiarity; Hevea as a latex yielder in Ceylon did not look at all exceptional—in fact, it appeared less promising than Castilloa. From similar incisions made in untapped trunks of these two trees much more latex flows from Castilloa than from Hevea—roughly five to six times as much. But if after the lapse of one or two days fresh incisions are made in the trees quite near the old ones, it will be found that from the Castilloa no latex, or very little, oozes out, while from the Hevea about double the volume given by the first wounds can be collected, and further, this tree will continue giving this and even larger quantities for some time to come. Consequently a very much greater weight of rubber will be obtained in a year from a tree of Hevea than from one of Castilloa of a similar size. The yields from estates planted with these two trees bear this out in a striking manner.

The planting of Castilloa in Mexico, as already mentioned, commenced a year or two in advance of that of Hevea in the East. Wound-response not being then known, the former seemed the more promising tree, as it yielded its latex with greater ease. At the present time, however, little is heard of Castilloa plantation rubber, while that of Hevea

* S. Arden, *Report on Hevea brasiliensis in the Malay Peninsula*, 1902 p. 15.

is making a sensation unparalleled in the history of tropical agriculture. This is wholly due to the advantage taken of the wound-response, which appears totally absent in Castilloa. The one gives pounds of rubber per annum, whilst the other gives ounces.

The latest accounts* of Castilloa in Mexico are not over-encouraging, but with rubber at anything like its present price, the estates now coming into bearing will doubtless prove remunerative. A six-year-old Castilloa apparently gives only 2 to 3 oz. of rubber in the year without seriously injuring the tree, whereas a Hevea of similar age will yield about a pound. At ten years old the proportion appears to be about 4 or 5 oz. for Castilloa and 3 to 4 lb. for Hevea. It seems that the more Castilloa has been studied from the economic standpoint, the less satisfactory it becomes, while, on the contrary, Hevea has ever continued to grow in favour.

This phenomenon of wound-response in Hevea is not only of great practical importance in rubber cultivation, but is also of considerable botanical interest; and requires more extended investigation. To what circumstances is the increased flow of latex arising from injury due? In Hevea the milk (laticiferous) tubes reside chiefly in the innermost third of the bark, *i.e.*, in the youngest and most functional part of the bast (phloem.) New tubes are continually being formed in the fresh phloem, produced by the actively dividing layer of cells, the cambium; these take the place of the older exterior tubes, which become compressed and eventually obliterated by the tree's expansion. If the laticiferous tubes in a definite area of bark were completely drained of their contents, two possibilities might happen. On the one hand this region might yield little or no latex, until the cambium formed new tubes—a process occupying some time; or, on the other hand, latex from the adjoining areas might flow in and refill the drained tubes, so that on retapping in a day or two an abundance of latex would exude. The first possibility may represent the behaviour of Castilloa, the second that of Hevea. In the latter tree the time would appear to be too short for any of the increased flow to be accounted for by the formation of new laticiferous elements. Probably in this case an injury causes an inrush of water into the surrounding intact tubes, and perhaps also into the severed ones, which will be now plugged by hardened latex. This flow of liquid towards the injured spot may be required for the reparation of the wound.

The latex which oozes out from a primary tapping of a Hevea tree is thicker, containing less water and more caoutchouc than that which flows from subsequent tappings; and further, it appears to give a poorer quality of rubber. In practice it is a disadvantage to have latex of a treacly consistency exuding, as much of it is apt to harden on the tree before it reaches the receptacle, producing inferior scrap rubber. In fact, the initial tapping is of little value from a rubber-yielding point of view; it only serves as the guide to future work. Sometimes drip-tins are fixed just above the tapping area. These allow water to drop slowly upon the incisions and so prevent the latex in its course down the trunk from drying on the tree. A little ammonia or formalin added to the water makes this device more effectual, as the coagulation of the latex is prevented by these reagents.

The latex from the second tapping is thus thinner and more copious, and it continues so far for many subsequent tappings. The percentage of caoutchouc in the latex resulting from this multiple tapping has, however, never been adequately worked out. Presumably the percentage (roughly 30 to 40) is fairly uniformly maintained for quite a long period (three to four months), but eventually falls, and a thin watery latex results, which does not pay to collect. This indicates that the tree requires a rest.

Wound-response appears to be a peculiarity of Hevea alone, or to speak more guardedly, it has not been shown to occur, as yet, in any other rubber tree to the extent that advantage may be taken of it in practice. It may exist in a much less marked degree, but this remains to be demonstrated.

Considering that the laticiferous system of Castilloa is of an essentially different construction from that of Hevea, it is perhaps not altogether remarkable that the two trees behave differently when tapped. In the former the laticiferous tubes are in mutual connection from the beginning. Special cells are differentiated in the embryo, and these produce by growth in length and ramification the whole laticiferous system of the plant. This is known as the non-articulate system.

* *India Rubber Journal*, 1909, Vol. xxxvii, p. 701. An article on Castilloa cultivation in the Quarter-century No. (p. 85) of this Journal gives higher yields, viz., about half those of Hevea.

In Hevea, on the other hand, the tubes arise from rows of cells through the breaking down of the intervening walls. The perforations are not always completely formed, so this, the articulate system, is relatively disconnected compared with the other.

A wound in a tree containing the first arrangement will therefore most likely drain a larger area of laticiferous tissues than one in a tree of the second type. This doubtless accounts for the greater flow of latex from an initial incision in the trunk of Castilloa compared with that from one in Hevea; but it is difficult to explain the wound-response in the one and not in the other. Perhaps Hevea has a much more extensive, though less communicative, system than Castilloa; or in other words, a trunk of Hevea has a much larger number of tubes, and so holds a greater quantity of latex than a corresponding one of Castilloa. At the first tapping the latter gives up practically all its latex, on account of the tubes freely communicating with one another; whilst the former only yields up a very small portion of its total quantity of latex, through the comparatively disconnected nature of its system. Thus from a single trial Castilloa appears the better yielder. On retapping in a few days' time no more latex exudes. The tubes apparently do not refill with liquid, and so probably collapse. In Hevea, however, a fresh set of tubes will be served at the second tapping, and if the new incision be made near the old one, the ducts here will probably be surcharged with latex owing to a great infiltration of fluid caused by the previous wounding; thus from such an incision an increased quantity of latex will flow.

A detailed microscopic study of the laticiferous systems of these two trees might shed some light on the above suppositions. Manihot, however, has a system similar to that of Hevea, and yet, as far as it has been investigated, it shows no wound-response. Johnson* experimenting with this tree in Portuguese East Africa, has failed to get it to respond to multiple tapping.

The Function of Latex.—A few words on the question of the function of latex are called for here. It is still largely a problem awaiting solution.

A nutritive function for the laticiferous tubes was at one time upheld. They were supposed to act as conductors of plastic material, especially of proteins, and were considered in some cases partly to replace the sieve tubes. Adherence to such a view has lost ground in recent years.

Spence,* however, has recently revived the nutritive view on somewhat startling lines. His studies on the oxidising enzymes of latex has led him to regard the caoutchouc as a food reserve, which by means of these ferments may be oxidised and broken down into simple carbohydrates for the plant's use. Physiologists will require much evidence before accepting such a novel theory.

That the tubes conduct or store food materials for the plant seems doubtful. Primarily the latex may be regarded rather as a waste product, and the tubes containing it as genetically related to, and a further development of, secretory sacs. But the substitution of an extensive system of communicating tubes in place of isolated sacs apparently implies the adoption of some new function in addition to that of removing the waste products of metabolism. A conducting function is the one which suggests itself. The tubes may form channels for the conveyance and storage of water. Laticiferous plants, at any rate the arborescent ones, are distinctly numerous in the tropics, where transpiration at times is excessive, especially during the dry season.

Again, the theory has been advanced that the latex serves as a protection against insects and fungi. In respect to an insect, a puncture or bite will result in an outflow of latex, which may interfere with its further operations or prove distasteful to it. The penetration of a fungus through a wound may be prevented by the latex, which oozes out, forming an impenetrable layer. This supposed protective function for latex must be investigated separately for each species in its original surroundings. The laticiferous system may have been evolved to repel certain foes occurring in the natural habitat of the plant, and yet be ineffectual against other enemies which the species may meet in a new environment.

The theory of water-storage and conduction is perhaps the most plausible. The watery nature of the latex in the trunk of Hevea has been noticed to be affected by the state of the soil. When dry, the latex is thicker and flows out less readily, suggesting that the tree is drawing upon the reserve of water accumulated in the laticiferous tubes. In the alluvial regions of the Malay States the tree yields latex very abund-

* W. H. Johnson, *India Rubber Journal*, 1908, Vol. xxxv., p. 209.

* D. Spence, *Bio-Chemical Journal*, 1908, iii., 179-81.

antly. Here there is surplus of moisture in the soil, and so the tubes are always well distended with latex. There is, in fact, no need to draw upon this reserve.

The removal of latex from the Para-rubber tree appears to have little or no detrimental effect. A young tree judiciously tapped continues to grow almost as well as one which has not been touched. Some observations made by Macmillan and Petch* have shown, however, that the seeds from tapped trees are, on the whole, lighter in weight than those from untapped ones. Any prejudicial effect of the tapping is probably due rather to the injury to and removal of the surrounding tissues than to the extraction of the latex itself.

Tapping Systems.—The demonstration of wound-response quickly influenced the method of tapping Hevea trees followed in the East. To gain the full benefit of this response, the new incision must be made quite near the previous one. Thus was suggested the feasibility of re-opening the old wound, rather than of making a fresh incision. Experience has shown that very satisfactory results can be so obtained. A thin paring of bark is removed from the lower edge of the initial groove at each subsequent tapping. By this means the bark down to the cambium is gradually shaved away. Thus excision instead of incision has come to control the tapping systems now in vogue.

The original small V-shaped cut has been completely abandoned. Attention to wound-response showed that a single slanting cut served just as well. Oblique incisions form the basis of the methods of tapping in use.

At first the latex from each incision was collected separately. This involves more labour, and has been generally discarded for basal collection.

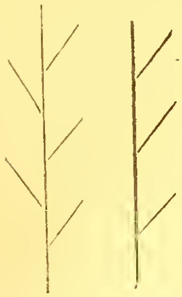
The two chief systems of tapping now practised on the estate are those known as the Spiral and the Herring-bone. The principle is the same in both. The initial grooving (tapping) forms a guide for all subsequent tappings performed during the year.

Spiral System.—A spiral groove is made in the bark of the trunk from a height of six feet to the base. If the incision is carried completely round the stem, then the system is called the Full Spiral; if only one part way round, the Half Spiral. A bole of small girth will only require one spiral. If of larger circumference, then an extra spiral can be added for each additional foot of girth; thus a tree three feet round would need three. At each tapping a thin shaving of bark is removed from the lower edge of the spiral cut. The pressure of latex is thereby relieved and a stream flows down the spiral into the receptacle placed at the base.

The full spiral, of all methods of tapping, yields the largest quantity of rubber in a given time, but it is very drastic, as the whole of the cortical tissues from the height of six feet downwards is removed, most likely too quickly for the maintenance of the tree's general health. It is now considered the best system to adopt for trees which are subsequently to be removed as thinnings or for other reasons. Rubber in quantity is thus obtained with the minimum amount of labour.

Herring-bone System.—A vertical groove is made in the bark of the trunk extending from the base to a height of five or six feet. Then long oblique incisions about a foot apart are cut from it in an upward slanting direction. If the inclined cuts are made alternately on each side of the vertical groove, the method is known as the Full Herring-bone; if only on one side, the Half Herring-bone, thus:

Full Herring-bone.



Half Herring-bone.

The oblique incisions yield the latex, and the vertical groove serves as a channel of conduction to the basal receptacle. At each subsequent tapping a thin paring is taken off the lower edge of each oblique cut; the vertical groove is left untouched. Thus the extraction of latex from the area of trunk covered by the herring-bone can be continued, till the whole of the bark intervening between the original slanting incisions has been excised.

The half herring-bone is now generally preferred, as being less severe than the full herring-bone. A quarter of the girth of the trunk can be tapped on the former system each year. By the time (four years) the whole has been so

* Macmillan and Petch, *Circular*, *Royal Botanic Gardens*, *Ceylon*, 1908, Vol. iv, No. 11.

treated, the renewed bark on the first area will be sufficiently mature to allow the multiple tapping to be recommenced.

Two important points should be observed in modern tapping. The wound should be re-opened by as thin a paring as possible; and every care should be taken not to injure the cambium. The longer the bark can be made to last, the greater, as a rule, will be the yield of rubber. Shavings of bark one-twentieth of an inch or even less in thickness are now managed in practice. A foot of bark can, therefore, be made to last for about 250 successive tappings.

A wound which passes through the cambium into the wood heals badly. In the excision method of tapping careless manipulation results in an uneven bark renewal, producing a surface difficult to tap in a systematic manner. Consequently to guard against cambial injury and to ensure thin parings much ingenuity has been exercised in devising suitable tapping instruments. At least two dozen different knives have already been invented for the purpose. Some of these have met with favour and are commonly used.*

Pricking.—Since economy in bark excision is so important, the idea that puncturing might be substituted to some extent for paring was early mooted. A tool, termed the pricker, was brought out for the purpose. Good yields were obtained by the combined use of the parer and pricker. The bark was thus made to last longer.

Recently a Ceylon planter † has introduced a pricking system as a complete substitute for the paring method. It has not as yet met with much favour.

Pricking has been blamed for the production of burrs and nodules in the renewed bark. Petch‡ has stated reasons for this view. If correct, it is a serious drawback to the use of the pricker. Though opinion generally seems rather opposed to than in favour of pricking, either in conjunction with paring or alone, yet it is still a debatable point. The paring method on the half herring-bone system is giving excellent results on estates and is very systematic.

The question may be asked: Will the tree stand this somewhat severe treatment of removing gradually its bark up to a height of six feet? So far, no pronounced ill-effects have shown themselves. The bark on the excised area is renewed satisfactorily, and this secondary covering is as rich or even richer in latex than the primary bark. This is on a par with the cinchona tree, which gives a greater yield of quinine from its renewed bark.

It has not yet been settled as to the time which should elapse before the reformed bark should be tapped. Four years has been considered a suitable period, but this may be possibly longer than is really required. Some results seem to show that if the new bark is tapped early, the rubber is of an inferior quality, even though the latex may be abundant.

Wickham* in his criticism of plantation methods, views with disfavour this system of removing the bark, and thinks that, in the long run, the incision mode of tapping, as employed on the wild trees in the Amazon, will be found to be preferable. His views seem generally to run counter to the practices in the East. At the same time, the opinions of one who is so well acquainted with the Brazilian rubber industry are not to be lightly laid aside.

High Tapping.—It has already been mentioned that, as a rule, it is not advisable to continue the tapping of a Hevea trunk above six feet. In the first place, the yield of latex is much less from the upper parts of the stem; and secondly, high tapping requires the erection of scaffolding, which adds greatly to the expense.

Interesting experiments as to yield have been carried out by the Ceylon Botanic Gardens Department† on the original Henaratgoda tree. These bring out clearly the great rubber-producing capacity of the basal six feet of trunk and the small yield afforded by the higher parts.

The improbability of obtaining rubber from the young stems, leaves, and unripe fruits will be referred to in the concluding portion of this paper, which will deal chiefly with the preparation of the rubber from the latex.

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* For details the reader is referred to Wright's text-book, pp. 79-88 (*Hevea brasiliensis or Para Rubber*, 3rd edition, 1908), and to the page of the *India Rubber Journal* for the latest knives.

† Northway's Tapping System—see article in *India Rubber Journal* 1909, Vol. xxxviii., p. 225.

‡ Petch, Circular. Royal Botanic Gardens, Ceylon, 1909, Vol. iv., No. 18.

* Wickham, *loc. cit.* p. 38.

† Royal Botanic Gardens, Ceylon, Administration Report, 1906, p. 32.

DANGERS, MISTAKES, AND IMPROVEMENTS IN THE CAOUTCHOUC PRODUCTION OF ASIA.

(By D. SANDMANN in *Tropenpflanzer*, March, 1910.—Abstracted by J. C. WILLIS.)

Commencing with a statement of the rapid growth of the industry, Dr. Sandmann points out that tropical Asia will be producing some 70,000 tons in 1913, according to the figures of production of the Malay States. This will greatly cheapen rubber, which should come into use in many new ways.

Trees measured in the Botanic Garden of Para, in Brazil, showed the following diameters at 3 feet from the ground :—

8 years old	14 1/3 cm.		($5\frac{1}{2}$ inch)
9 ,,	16	...	($6\frac{1}{4}$,,)
10 ,,	26	...	($10\frac{1}{4}$,,)
11 ,,	$28\frac{1}{2}$	...	($11\frac{1}{4}$,,)

These dimensions were much exceeded by trees of corresponding age in the Malay States and in Java.

The yield in Brazil he calculates to be about $1\frac{1}{3}$ to $3\frac{1}{2}$ kilos (3-8 lbs.) a year, at the age of at least 15. This also is beaten by the cultivated trees.

He then goes on to describe the various enemies that attack rubber in Asia; *e.g.*, the root fungus, the white ant, &c.

The labour difficulty is then dealt with.

Dr. Sandmann next goes on to consider the raising of milk production, pointing out that in the future it will not pay to tap such trees as are now tapped. He saw, for instance, trees of ten inches girth being tapped, with a yield of $3\frac{1}{2}$ oz. He recommends selection of seed from heavy bearers; the rubber tree being, as is well known, very variable in this respect.

He compares the growth of seedlings planted out with that of stumps, showing that the former is decidedly better. He describes the various theories held about weeding, the abandonment of thumbnail-pruning, and the various knives in use for tapping.

He considers the question of how often to tap, pointing out that so many factors enter into it that each planter must decide for himself.

(*To be continued.*)

THE JEQUIE MANICOBA RUBBER TREE.

BY R. THOMSON.

(From the *Indian Forester*, January and February, 1910, Vol. XXXVI., Nos. 1 & 2.)

This new species of rubber is indigenous to the State of Bahia, Brazil. It is a small tree, attaining a height of some 25 feet, with stems from 18 to 20 inches in circumference. It is a closely-allied species of the Ceara-rubber, the native habitat of which is separated from this Manicoba region by some five or six degrees of latitude. Until a few years ago this rubber was unknown to commerce. It grows under peculiar conditions as a product of the forest. In the region I traversed there are millions of trees, including saplings. The soil in which the Manicoba grows is peculiar. (I have samples of it in London). It is a porous kind of clay, more porous than sticky, the texture of which is eminently conducive to the well-being of the tree during prolonged periods of drought to which it is exposed. Apart from the peculiar character of the soil, its great depth powerfully contributes to the conservation of the moisture which it freely absorbs during the short rainy reasons. In other words, the absorbent power of this great body of earth, not only relieves the surface of any excess of moisture, but retains the moisture during severe droughts, so that the soil is never water-logged, and never excessively dry. This soil, therefore, coupled with the aridity of the climate, is the secret of the existence and diffusion of this rubber tree.

A few years ago I was deputed by Messrs. Elder, Dempster & Co. to investigate the resources of the pineapple region of Florida. I mention this by way of pointing out the disparity between that soil and the Manicoba soil. I quote from my published report :—"If the soils of Florida were anything like the soils of Jamaica, it is safe to say that Pine-apples would not be cultivated there at all. The soil in which they are planted consists of from 96 to 98 per cent. of silica. The growers furnish all the food by fertilisers, which bring forth luxuriant crops . . . On examining a large pineapple field that had been some months before uprooted in order to prepare the land for replanting, I saw many hundreds of rejected suckers that had been cast away over the land actually bearing fruit! In other words, these suckers yielding fruit had no connection with the soil; other than lying on the surface.

I was puzzled. But, on reflection, I arrived at the conclusion that this phenomenal productiveness was due to the great depth of the bed of sand, probably 50 feet, which issued moisture from its huge mass on the principle of capillary attraction."

The supreme importance of soil is further exemplified by the following extract from the *India-rubber World*:—

"After having travelled through all the desirable rubber regions in Central America and Northern South America, I am satisfied that suitable tropical forests which can be had now at a low price—often for a few cents an acre—present an opportunity for the profitable employment of capital such as has seldom been offered in the world's history, but the serious point is to secure the proper land. Those who acquire it will have more than they expect, but natural rubber lands are not to be had by simply making a chance location. Though the tree will grow almost anywhere, it is only the most favoured spots that will yield those spontaneous returns that are so very profitable. It is fair to state that if people go to taking up tropical forests promiscuously, ten will be disappointed to every one who secures a prize."

In the remote district in which this tree grows, the vegetation may be described as a scrub forest. The Manicoba tree throughout certain areas intermingles with the stunted trees and forms a prominent part of the forest at an elevation of 1,000 to 2,000 feet above sea-level. In the forest there are comparatively few species of trees that exceed a medium size. The country is gently undulating, with low intervening hills. The whole region presents the aspects of a semi-desert, consequent on the character of the soil, which is non-productive of luxuriant tropical vegetation.

Throughout this dreary tract of country, embracing many thousands of square miles, miles at a time are destitute of inhabitants. Running streams of water, so impressive and emblematic of fertile regions, are few and far between throughout the district. At distances, usually many miles asunder, the configuration of the land admits of natural reservoirs which, aided by simple devices, supply the wants of man and beast. Thus, the water is collected at the bases of hills and sloping lands where cavities are formed. Wild animals, including insects, are also rarely encountered. In this connection it is worthy of note that cultivated Manicoba trees appeared to be practically immune from insect depredations. Ants sometimes overhaul the young leafage, and a young tree is sometimes snapped off at the top by a stray deer.

Another noteworthy feature of this scrub forest may be indicated. The foliage is scant and lacks profuse development in conformity with the stunted tree vegetation, but it is accompanied by innumerable growths of thorns and spines that contest supremacy with the foliage itself. I have travelled on horseback through many thousands of miles of tropical lands, but never through any part having a tithe of these formidable weapons. The sterility of the region is mainly accountable for this evolution of thorns. Most of the species become thorny, and the thorny species are reproduced superabundantly.

Notwithstanding the severe droughts characteristic of this region (probably the rainfall does not exceed 25 inches a year), droughts lasting six months, and even nine months at a time, many shrubby species of the natural order *Malvaceæ* were constantly found in proximity to Manicoba trees. I am intimately acquainted with many species belonging to this order in the tropics, and I was surprised to see numerous species flourish under such conditions of aridity. There can be no doubt that this phenomenon is ascribable to the peculiar structure of the soil. Many species of *Cacti* are interspersed in the scrubby thickets, these being more concentrated at points where the soil is exceptionally arid. It was curious to see several species of palms, moisture-loving plants, struggling for existence in these ungenial thickets. Half-a-dozen species of native *Ficus*, fine umbrageous trees, flourish adjacent to settlements. (I thought that *Ficus elastica*, Rambong rubber, could be grown to perfection here.) Ferns are non-existent, though I saw after riding 360 miles, a few puny plants in a dark ravine. I visited a coffee plantation at about 3,000 feet altitude. This was the only coffee plantation on an area of many thousands of square miles. The coffee plants yield very small fruit. At this height frequent rains are experienced. And coming from the inland towards the city of Bahia, rains are more frequent, the soil is darker—an ameliorating factor. Tobacco of splendid quality is extensively cultivated here by thousands of small settlers. In juxtaposition *Cassava* (Manioc), the staple food product of Brazil, a congener of Manicoba, maize and other products, in patches, are commonly cultivated, and crops are obtainable there from a few months after the rainy season.

In a report of mine issued by the Agricultural Society of Jamaica, about a year ago, on the Virgen rubber of Columbia (it has been reprinted in many countries), I emphasized the importance of rubber cultivation in comparison with the sparse returns obtainable from wild trees. This is applicable to Para rubber and all other important species of rubber, including Manicoba. In a state of nature, rubber trees struggle for existence amidst a thousand other species of trees. In the near future all rubber must be produced by cultivation like any other great agricultural commodity.

During the past year various owners of Manicoba rubber land have been directing attention to the culture of this tree. I visited several plantations ranging from a few acres to a hundred acres. I was anxious to investigate the cultural capabilities of the tree. The owners of these lands are ignorant of the lines on which this culture should be initiated They take it for granted that sticking the Manicoba seeds or cuttings into cleared ground is all that is necessary without further attention. One important factor is in their favour: I refer to the wonderful tenacity of life and recuperative power pervading this plant. The primitive procedure by which the incipient seedlings and cuttings are left to take care of themselves with a view to establishing plantations is antagonistic to the development of the trees, for nothing is more important than the proper treatment of young plants in the establishment of great prospective plantations. The result of the preliminary attempts in question was an aggregation of maltreated plants. In this connection it may be noted that about half-a-dozen labourers only, men who know nothing about cultivation and nobody to instruct them, perform all the work appertaining to the upkeep of such plantations, comprising some fifty thousand plants. Of course, they have but few weeds to contend with, an important consideration, as they are in general suppressed by the peculiar soil and climatic conditions. I therefore could not help coming to the conclusion that, if these impoverished plantations were placed under my control, I should re-plant them throughout. Anyhow it is important to be able to add that I found two notable exceptions to this crude style of planting, one of which having a few thousand plants, and the other fifty thousand, on both of which intelligent methods of planting had been adopted. And these two plantations, from a practical point of view, were decidedly encouraging. The seeds and huge cuttings or stumps were only four months planted. The seedlings in this time attained a height of from four to five feet, and they were exceedingly healthy and vigorous. The huge cuttings are procured from the forest, that is to say, saplings in the forest are cut down and stuck into the cleared ground to form roots and permanent plants. These stumps measure from six to eight feet in length, both ends cut off, and in four months the vigorous shoots that spring from the tops are four and five feet in length, thus a continuity of growth from the sapling to the established tree.

This plant is an invaluable acquisition to rubber cultivators. It can be cultivated at a minimum cost consequent on its persistent tenacity and vigour as is exemplified in its native soil, and consequent on its other merits to which I have drawn attention. Further, it may be stated that this tree is comparable with particular products cultivated in the tropics and elsewhere, products that flourish in a great measure by the restricted cultivation given. That is to say, when we discover a region pre-eminently adapted for a given culture, there it yields not only the best produce of its kind, but also far more economically.

Again, the humble dimensions of the Manicoba tree, I am convinced, is a factor in its favour from a cultural point of view, for it attains to a size exactly suited for close planting. In the *Hevea* (Para rubber) plantations under cultivation in the East, close planting is systematically resorted to with the object of forcing early crops which are available from young trees of limited size, for numbers collectively far more than compensate for the production of rubber per acre from full-grown trees widely planted. As a matter of fact, big trees are stated in the East to be an encumbrance.

The number of trees usually planted in the East run from 100 to 200 per acre, sometimes more. The number of Manicoba I advocate to be planted is 1,200. I estimate that 1,200 trees per acre (exclusive of certain returns in the fourth year) will yield 600 lbs. of rubber in the fifth year; and at least the same quantity annually thereafter for a long period of years. In many rich Manicoba zones I computed the number of wild trees at more than 100 per acre, some 25 per cent. being tappable trees, most of the remainder saplings, the forest growth of which is sluggish as compared with cultivation. It may be observed that a wild tree occasionally yields one pound of rubber at a tapping, but the average

is far less. One of the advantages, a subsidiary advantage, to accrue from cultivation is that of systematic control of the cropping by a special staff of workers, for the itinerant collectors of wild rubber cannot always be counted upon.

I detected in the Manicoba forests several distinct varieties of this tree, and on enquiry I found that one particular variety was recognised as being richer in latex than others. The varieties are distinguished by colour, size, and lobe formation of the foliage, which latter are remarkably vigorous in cultivated plants. The uncultivated trees are sparsely furnished with foliage. I have had considerable experience with regard to the effects of soil on rubber plants. Apart from the large plantation of *Virgen* rubber which I established in Columbia, I planted experimentally more than quarter of a century ago, both in Jamaica and in Columbia many plants of Ceara, a nearly related species of Manicoba. Furthermore, I introduced to Jamaica many plants of Para rubber, *Castilloa* and Virgen rubbers. Unfortunately, until recently, no attention has been paid to their propagation in that colony.

The *Hevea* (Para rubber) is indigenous to another part of Brazil. In addition to the boundless tracts of country throughout which it is dispersed, it is a large tree. It furnishes in a wild state most of the rubber found in commerce. But the natural resources of the forest gradually dwindle. This is the tree for cultural purposes that has claimed the attention of the capable planters of the East with far-reaching consequences. The species flourishes in conditions of soil and climate the converse of those requisite for the humble Manicoba tree. Hence, the latter species can never be cultivated side by side with its great Amazonian rival.

Supplementary to my foregoing account of this species of rubber, I think it is important to cite from, and append hereunto, an interesting article in the Kew Bulletin, No. 2, 1908, on this subject, which, *inter alia*, contains much information supplied by Mr. O'Sullivan Beare, H. B. M's Consul at Bahia, to whom I had a letter of introduction from the Governor of Jamaica.

In the year 1906, Dr. Ule, a German Botanist, who visited Bahia, named the Jequié Manicoba, *Manihot dichotoma*.

"The Jequié Manicoba is undoubtedly a new and distinct species of *Manihot*, and it must not be confounded with the *Manihot* of Ceará, *Manihot Glaziovii*. This discovery is a matter of much importance, not only to this State, but also for the rubber trade in general, inasmuch as the rubber obtainable from the Jequié Manicoba when properly prepared would seem to be equal in quality to the best product of the Para region.

"The season for extracting the latex from the Jequié Manicoba extends from August to March. The latex possesses the valuable property of coagulating spontaneously when exposed to the air, and it requires no acid or artificial coagulant of any kind."

"A planter, established in the Jequié district, recently prepared a considerable quantity of rubber obtained from Manicoba trees growing wild in that neighbourhood, and despatched it to New York. The consignment was classified in the New York market as being equal to the best Para rubber, and it fetched one dollar twenty cents (5s.) per lb."

In addition to *Manihot dichotoma*, two distinct and nearly related rubber-yielding species were found by Dr. Ule, "the one growing on the mountains of the right bank of the Rio San Francisco, and the other, confined to the country at some distance from the left bank, occurring especially in the adjoining State of Piauhy." . . . These two species are described under the name *M. heptaphylla and M. piauhyensis.*

My examination of this species of rubber, *Manihot dichotoma*, in its native habitat, set forth in my preceding account, shows that I am impressed with the remarkable possibilities of this rubber-yielding plant, thus having arrived at the conclusion that, under cultivation, it is destined to rank in productiveness, per acre, second to none. It therefore seems obvious that some confusion has arisen in the publication of a paragraph in the Kew Bulletin, wherein this species as regards its rubber-yielding capacities is undoubtedly misrepresented. A comparison is made with this and the two other allied species, namely, *M. heptaphylla* and *M. piauhyensis*. In this comparison it is stated that the yield of rubber per tree under cultivation for the two latter actually exceeds the yield for *M. dichotoma* five-fold? Thus, "the yield of rubber from a single tree of *M. dichotoma* in one year can be reckoned at from 100-200 grammes." And, the annual yield of rubber for single trees of *M. piauhyensis* is from 500-1000 grammes." Said paragraph is here subjoined.

"PLANTATIONS.—At present the plantations of *M. dichotoma* are rather young and only the oldest are ready for tapping; but from the two other species, which have been known longer, a satisfactory amount of rubber is now being brought on to the market. In the plantations which are laid out in quite primitive manner, the seeds are planted in rows two metres apart, making 2,500 trees to the hectare (2·47 acres). Other plants may be grown between the rows during the first year. With regard to tapping, *M. piauhyensis* is ready in the third year, and the other two species may be tapped in their fourth year of growth. The yield of rubber from a single tree of *M. dichotoma* in one year can be reckoned at from 100-300 grammes with present methods, and this is equivalent to 200-300 kilogs. per hectare. The annual yield of rubber for single trees of *M. piauhyensis* and *M. heptaphylla* is from 500-1000 grammes, which corresponds roughly to about one tonne per hectare."

RUBBER STATISTICS OF HAWAII.

By D. C. LINDSAY.

(From the *Hawaiian Forester and Agriculturist*, Vol. VI., No. 12, December, 1909.)

There are in the islands five incorporated companies whose principal business is the growing of rubber. Statistics have been obtained from all of these and also from two individual planters.

No statistics were received from Kauai or Oahu.

Six reports were received from Maui and one from Hawaii.

The acreage controlled by these companies and individuals is 5,599 acres.

The acreage planted at date is 1,338 acres.

Acreage planted: Hevea 242; Ceara 1,092; other varieties, 4; total 1,338.

Total trees planted: Hevea, 79,940; Ceara, 349,400; other varieties 800; total 430,140.

Average of girth: Hevea, 2 years 6, 3 years 8; Ceara, 2 years 8, 3 years 14.

Four places practice clean cultivation. Two of them consider it absolutely necessary. One manager reports that it is entirely too expensive and two have not tried it. The approximate cost of cultivation per acre runs from $14·00 to $24·00 per acre for the first year and lighter for following years.

Inter-crops, such as corn, potatoes, beans, oats and green vegetables are planted on parts of two plantations, while one manager reports that pineapple has been tried, but without success.

One manager reports that inter-crops are profitable only as the returns reduce the cost of cultivation, but would not be profitable otherwise.

Only experimental tapping has been done and the result is yet undetermined. One manager reports very good results.

From reports received there are 11,000 trees that may possibly be tapped commercially during the year 1910. One plantation reports that fertilisers are too expensive to use in quantities enough to be beneficial. Two have not used them. Three places report the use of fertilisers with excellent results and one with fair returns.

For the purpose of getting statistics for next year that might be more reliable and more detailed, I would suggest that a committee of three be appointed; one on Oahu, one on Maui and one on Hawaii, and each one attend to the securing of data on the island on which he resides. These could then be tabulated as desired.

RUBBER CONVENTION.

(From the *Hawaiian Forester and Agriculturist*, Vol. VI., No. 12, December, 1909.)

The third annual session of the Hawaiian Rubber Growers' Association was held on Thursday, December 16th; both morning and afternoon meetings bringing forth a large attendance. The following program was announced by Mr. Fred. L. Waldron, President of the Association:—

"Hevea or Ceara in Hawaii," Mr. C. J. Austin.

"Inter Crops," Mr. L. F. Turner.

"The Rubber Situation in Hawaii," Mr. W. A. Anderson.

"Rubber and the small Farmer," Dr. E. V. Wilcox.

"Rubber and Reforestation," Mr. R. S. Hosmer.

"Tapping," Mr. F. T. P. Waterhouse.

"Marketing Rubber," Mr. F. L. Waldron.

"Rubber Enemies," Mr. E. M. Ehrhorn.

There are in the islands five incorporated companies, whose principal business is the growing of rubber. Statistics were read from all these and also from

two individual planters. The whole Territory was represented with the exception of Oahu and Kauai. Six reports were received from Maui and one from Hawaii. The area controlled by rubber companies and by individuals in the islands is 5,599 acres. Of these there are planted to date 1,338 acres, namely, 242 acres in Hevea, 1,092 in Ceara and 4 acres in other varieties. The total number of rubber trees planted is 430,140, of which 79,940 are Hevea, 349,400 in Ceara and 800 of other varieties.

Four plantations practise clean cultivation, the managers of two of these considering it absolutely necessary. From reports received there are 11,000 rubber trees that may possibly be tapped commercially during the year 1910. Fertilisers are considered too expensive to use in sufficient quantities at present to be remunerative.

The first speaker, Mr. C. J. Austin, dwelt at length upon the relative merits of Hevea and Ceara as an Hawaiian rubber crop. Although Ceara is a somewhat quicker producer than the former, the speaker gave his preference in favour of Hevea, which is now doing exceedingly well on the island plantations. The average time, after planting, for tapping Hawaiian trees was stated as not exceeding six years.

Mr. L. F. Turner read an interesting paper upon inter rubber crops and brought forward much invaluable information. Such catch crops as corn, cucumbers and melons were recommended to be grown between the young trees, as by this means expenses during the initial stages of the plantation can be greatly reduced. Care should be taken to grow crops which do not make too great demands upon the soil. A method which has been tried with success is to let out certain portions of the plantations to Japanese cultivators, who attend to the young rubber trees in return for the use of the intervening spaces for growing other crops.

Dr. Wilcox, Director of the local Federal Experiment Station, delivered an instructive address upon the cultivation of rubber, chiefly with reference to the question whether a man with a small area of cultivated land was likely to be able to derive an income from rubber trees, and also his opportunities for disposal of the latex.

One of the first difficulties that meet the man in connection with rubber is where the best locations for rubber-tree growing are to be found; that is, for planting small areas. The first question that arises is what crop he may grow and receive sufficient for to make a profit while waiting for his tree to mature. Dr. Wilcox felt that a man with a small holding of a few acres must be close to a larger plantation which is provided with all the machinery for working up the latex.

There are many small locations which a larger plantation does not care to use, where a man could have from five hundred to a thousand trees or perhaps more. The speaker said it would be a wild scheme to suggest to a man with four or five acres that rubber could be made a source of income therefrom. If a man with a small area developed other products from which he could make a living, then he saw opportunities to enlarge. He believed, however, that the operation of a small rubber plantation not so situated with regard to a larger one that it could dispose of its latex, would not meet with any great success.

Dr. Wilcox was also very certain that when the growers began to tap the trees on a large scale it would be necessary to set a standard of grade. It is obvious that the market wants certain kinds of rubber more than others. If the Rubber Growers' Association wants a rubber standard in Hawaii it will be necessary to adhere strictly to that standard. The easiest way to destroy confidence in the standard of rubber is to fail to maintain it.

To make the rubber business a success it is necessary to grow other crops as well. Of course, the difficulties confronting the small farmer in Hawaii were greater than those which confront a mainland farmer, owing to the transportation cost, and other disadvantages.

Taking bananas as an instance, Dr. Wilcox said there have been dozens of shipments from Honolulu to the mainland which have arrived in San Francisco in good condition, but the receipts have been so small that the freight could not be paid. A man on Maui cannot therefore raise bananas and other like products and expect to market them in San Francisco.

The pineapple situation is somewhat similar, especially as to shipping fresh fruit. Tremendous loss is sometimes sustained from rot, and the enormous cost of shipping in cold storage, to prevent that rot, is almost prohibitive. He instanced shipments from one pineapple plantation which has practically lost $4,500 on its crop, the receipts not having even paid for the freights.

Under these conditions there are left only a very few crops which can be safely grown by the small grower with

the idea that there is to be a certain market for the product. The speaker had no hesitation in saying that rubber can be grown that will give a reasonable price, provided it is brought to the market in a standard form.

He spoke of his recent visit to the mainland, and the fact that in many instances where he registered at a hotel, rubber men came to him and asked if rubber was being produced in Hawaii. They wanted to know how much they could get here. He believed that cotton could be grown as a by-product with rubber, but did not recommend tobacco, as the latter depleted the soil too much and would therefore have a bad effect on the rubber trees.

Mr. F. T. P. Waterhouse now gave an instructive address on the methods of tapping rubber trees as practised in the Straits Settlements, from which he has recently returned. Mr. Waterhouse reported that a great advance had been made in this department of production, since his visit to the rubber plantations there a year ago. Whereas on the former occasion many different methods were in operation and various tools were in use, now a general standard of procedure is observed. The coolies, who are employed for tapping have become more expert and better results are obtained. Owing to the increasing demand for rubber the trees are tapped at an earlier age. Disc harrows are being used in Java to cultivate between the rows of trees, and much benefit is derived from this operation.

Speaking of the pests of rubber trees, Mr. E. M. Ehrhorn, Superintendent of Entomology, cited the shot-hole fungus and the blight which disfigures the banyan trees. For these enemies he recommended an application of Bordeaux wash before the trees had attained too great a height.

EUPHORBIA LATEX FOR PREVENTING CORROSION.

(From the *Agricultural News*, Vol. IX., No. 203, February 5, 1910.)

In Newman's *Metallic Structures* an account is given of the use of the milky juice of the Euphorbias (spurges) for preventing corrosion. It is stated that it is only in comparatively recent years that the preserving qualities of Euphorbia latex have been made use of in engineering structures, and then only occasionally. A description is further given of the way in which this property was discovered. It appears that, during a surveying expedition in Natal, it was noticed that, when Euphorbia plants were cut by the clearing knives, the juice formed a layer on them which could only be removed with great difficulty. Further experiments with pieces of iron that had come into contact with the juice showed that these did not rust, and that when they were immersed in sea water, at Durban, they remained free from brancles and were not affected by any form of marine life. In Natal, laths coated with Euphorbia latex, together with those which had not been so treated, were thrust into nests of the white ant (*Termes bellicscus*); after twenty-four hours, the treated laths were found to be unaffected, while those which had not come into contact with the juice were completely riddled by the insect. It is further stated that timber coated with Euphorbia latex remained untouched by the sea worm, *Teredo navalis*, and mention is made of the employment of the juice in making paint.

Since this, according to the *Agricultural Journal of the Cape of Good Hope*, as a result of enquiries on the part of the Somerset East Chamber of Commerce, it has been ascertained that the above statements regarding the preserving properties of the juice are correct, and that, although owing to its gummy nature it is no longer used in paints, it is employed by makers of compositions for ships' bottoms, and an attempt is being made to create an export trade in the article from Cape Colony.

OILS.

CITRONELLA-OIL TESTS.

(From the *Chemist and Druggist*, Vol. LXXVI., 1571, March, 1910.)

Reference was made in the *Chemist and Druggist* last week, p. 340, to the persistent adulteration of bulk citronella oil, and the desirability for altering the terms of sale in London. It is a long standing complaint (we had almost said "joke") that citronella oil is faked to pass Schimmel's test, and repeated efforts to establish an honest basis so as to secure supplies of pure bulk oil have had little success. In the first issue of Mr. John C. Umney's "Perfumery and Essential Oil Record," reasons for a "London Standard" were advanced. Mr. Umney wants the oil to be: sp. gr. 0·900 to 0·915 opt. rot. (100 mm.) 0° to—15°, ref. ind. about 1,4800 acetylisable constituents at least 60 per cent., and solubility 1 vol. in 2 to 3 vols. of 80 per cent. alcohol, the solution remaining clear on the addition of the same solvent up to 10 vols. The first, second, and third of these factors are also recommended by Parry and Bennet, who agree generally with the others, and they are well suited to distinguish oils which are pure from those which are adulterated with kerosene or resin spirit. In the second number of the "Record," published this week, the Editor's suggestion is supported by, amongst others, Mr. Holman Kingdon, buyer for Messrs. John Crosfield & Sons, Ltd., who emphasises the desideratum that "The only real standard is purity, and this possibly with determination of geraniol content the only real basis for any judgment of value." A leading Mincing Lane broker also insists that the oil should be sold on geraniol constituent (geraniol and citronellal) stated as geraniol. The "Record" adds that the proposed London standard has aroused widespread interest, and the Editor is confident that in a short time difficulties as to citronella oil will have vanished. A useful service will have been done by the "Record" in securing agreement on this matter thus early in its career.

EDIBLE PRODUCTS.

PRODUCTS OBTAINED FROM CACAO.

(From the *Agricultural News*, Vol. IX., No. 203, February 5, 1910.)

The three cacao products known to commerce are: cacao butter, cacao powder, and cake chocalate, the manufacture of chocalate requiring skill and knowledge in special degree. The butter is merely the oil or grease of the kernel, usually extracted by pressure and leaving a residue still containing a certain amount of vegetable fat, which, being ground as will be explained later, is used in making the beverage commonly known as cacao. When chocolate is intended to be produced, the carefully cleaned kernels are crushed into a mass, flavoured and manipulated according to many methods, and then, after an addition of pure cacao butter has been made to the natural content of the mass, it is pressed into small cakes, and sold.

The cacao bean is composed, by weight, of 88 per cent. of kernel and husk and 12 per cent of shell. The shells and husks are treated chemically in Holland for the production of a low-grade butter, the reduction being effected by ether or benzene. The kernel, which contains 50 to 55 per cent. of oil, was formerly treated, when the extraction of butter was contemplated, by boiling, roasting and crushing in ten times its weight of water; the oil then rising to the surface was decanted, and the residue pressed mechanically for the elimination of such butter as it still contained. This method has been abandoned, and the kernels, freed from their envelopes, are now ground to a mass, brought to a temperature of from 60° to 70° C., placed in coarse linen sacks, and finally pressed in steam-heated machines. After this first application of pressure the cocoa cake contains from 20 to 35 per cent of fat; it is then ground and repressed until not more than 15 per cent. of the fatty matter remains. The oil or grease which has been extracted is called "cacao butter" which is used chiefly by cacao manufacturers, and, in smaller quantities, in the soap, perfumery, and pharmaceutical industries, in which, owing to its neutral qualities, it is especially valuable.

Fresh cacao butter is yellowish white, but if exposed to light it becomes entirely white, and possesses a mild odour of the

cacao and a sweet and agreeable taste. Both taste and odour are eliminated by boiling the fat with absolute alcohol, and in this condition it keeps a long time without becoming rancid. It is firm in consistency and melts at from 32° to 35°C.. according to quality. Its density varies from 0·890 to 0·900 at 15°C. It is very soluble in ether, acetic ether, chloroform and essence of turpentine. It is sometimes adulterated with a mixture of stearin, paraffin and beef fat. If it is mixed with fatty oils it melts at a temperature of less than 25°C., and if it is mixed with paraffin and beef fat it melts at a temperature in excess of 35°C. If pure, the point of fusion should not be less than 25° nor more than 30°C.

The butter having now been withdrawn from the mass there remains an oily cake, which is ground to a fine powder, and commands a very wide sale. The powder is usually prepared, according to the Dutch method, by the addition of a solution of chemically pure potash. Less frequently, soda is used instead, or perhaps a solution of ammonium carbonate. In ordinary practice, the raw beans with their shell might be expected to yield from 40 to 45 per cent. of their weight in butter, and 30 per cent. of cacao powder.

MATÉ OR PARANA—TEA.

(HEINZE in *Beih. zum Tropenpflanzer*, February, 1910.—Abstracted by J. C. WILLIS.)

Maté (*Ilex paraguayensis*) occurs in several varieties, and other species of Ilex are sometimes used as substitutes. It is found mainly in the highlands of the Parana basin, between 20° and 30°S. latitude and at elevations from 1,500 feet upwards.

The plants are grown from seed, and planted out at six months old. Cutting is done only in the six colder months, and the tree when cut back is allowed three or four years' rest. The branches are hacked off and passed once or twice through the flames of a wood fire. The large stems are then removed, and the best maté is dried on a barbecue (specially constructed as described in the paper) for not more than six hours.

After drying the maté is broken up by a machine, and is then raw maté, which is later pulverised and sifted.

Details and statistics of trade are then given.

SOME COMPARATIVE CROP VALUES.

(From the *Louisiana Planter*, Vol. XLIV., No. 10, March 5, 1910.)

The cry now-a-days is for American lands to produce the heaviest possible food crops. It is worth while to note the yield and value of three of our grain crops in comparison with the returns of bean and cane sugar.

The wheat fields of the United States yield about 15 bushels to the acre, which is considerably less than those of England, France, and Germany after centuries of rotative and scientific cultivation. After the original preparation of the land with the plough and harrow and the planting of its seed, wheat is grown without further cultivation. One man and a boy with four horses and modern implements to prepare the land can attend to about 150 acres of wheat up to the harvest. It is cheaply harvested, being reaped rapidly and threshed by steam machinery. On the farm it is worth about $1 per bushel, $15 per acre, and $2,250 as a gross return for the man and boy's work, from which the harvest expenses must be deducted.

Our corn crop is the greatest and most valuable of our agricultural productions. Last year it reached very nearly three million bushels, and year before last two and three-quarter millions, and was valued each of the two years at $1,500,000. The average yield of the corn states was about 27 bushels to the acre. One man with a team is supposed to take care of about 40 acres of it, giving it two or three rounds of cultivation during its growing season. Its harvesting costs little, and is often done by droves of hogs and herds of cattle turned into the fields to fatten on it. It is worth on the farm about 50 cts. a bushel, $13·50 per acre and about $540 as the product of one man's work.

Our Southern rice returns an average yield of about 30 bushels to the acre, as did last year. The work necessary to this crop is so variable according to locality, that one man's capacity in its production up to the harvest could be more guessed at than measured accurately. It would be probably 40 acres on the level drainable prairie lands, and 20 acres on the low "riverlands" of Louisiana, and the rice swamps of the Carolina coast. Taking the average at 30 acres, that area must be ploughed, harrowed and planted, irrigated until it is ready for the harvest, and weeded usually during the first part of its growth. According to its location its harvest is cheap or costly, grown where

wheeled reapers can run it is very little more expensive than wheat. Taking a ten-year average it has been worth about 75 cts. a bushel, or $22·50 an acre, or $675 as one man's crop.

Assuming the yield of sugar beets to average about 12 tons for all the best sugar States of our country, and that to be worth $5 per ton prepared for shipment in the field; and we have $60 to the farmer, and about the same amount to the manufacturer as a gross return from that crop, counting the sugar yield of the beet as 250 lbs. of raw sugar per ton, and its price 4 cts. a pound.

The corresponding fair average yields, such as the crops already named, sugar-cane in the Gulf States should give about 18 tons to the acre, counting the cane in cultivation for the mill, and not that grown for seed, nor the land necessarily devoted to rotative crops. That on the basis of present sugar prices should be worth about $4 per ton, or $72 per acre, ready for the factories and considering its yield as the equivalent in total of 160 lbs. of raw sugar $2·40 more at the factory, making the gross value of the crop of an acre of sugar cane $115, being near or about the same as that of sugar beets.

With the relative cost of cultivating and harvesting these crops, this article has nothing to do. It is meant to show the comparative value of certain productions of the soil; that $115 or $120 gross return of an acre of beets or of cane comes out of the ground, and furnishes about seven or eight times as much money for somebody's benefit and for many more people's benefit as did the return of an acre of wheat or corn.

The home beet and cane sugar crops appear to yield the greatest amount of nutritious food to the area in cultivation, manifold as much money to the acre as the greatest of the grain crops, afford more remunerative work to the farmer and long and profitable employment to many thousand labourers of the temperate zone, who, without such crops, would be compelled to idle for half the year after the grain crops were harvested.

RICE-GROWING IN THE UNITED STATES.

(From the *Agricultural News,* Vol. IX., No. 203, February, 1910.)

The following information is obtained from an article in the *Rice Belt Journal,* in which is summarised the information given in the final report of the Bureau of Statistics of the United States Department of Agriculture, issued on December 20, 1909:—

In area, Louisiana leads with 375,000 acres, Texas follows with 291,000, and Arkansas comes next with 28,000; South Carolina has 18,000 acres, Georgia 4,200, Florida and Mississippi, 1,000 each, and north Carolina 425 acres. In this connection it is worthy of note that the greatest increase next year will be along the Mississippi river and in Arkansas, where considerable development is taking place. The greatest increase will be in eastern Louisiana, and there are prospects of considerable increase in the State of Mississippi, while Arkansas may safely be expected, according to the well-informed, to double its present acreage. There will be an increase in Landry Parish, Louisiana, but in the parishes of Acadia, Calcasieu and Vermilion, a material decrease is certain, although 10,000 acres of new land will be put in by the United Irrigation and Rice Milling Company, which is extending its canals. The total acreage of rice in the United States is placed at 720,000—a reduction of 11,000 from the preliminary estimate, and an increase over that of last year of 65,000.

In yield per acre, Arkansas leads with an average of 40 bushels; Alabama follows with 35, and Texas comes next with 34; Louisiana is two-tenths of a bushel behind Texas, its production being 33·8 bushels per acre; North Carolina averages 30·2 and Mississippi 30 bushels, while South Carolina produces only 25·6 bushels to the acre, on an average, and Florida follows with a still lower average.

The average price per bushel of rough rice on December 1 was 79·4c. The price of South Carolina rice led at ·19c., Arkansas rice followed at 90c., and Georgia and North Carolina rice came next at 87 and 85c. respectively. Florida, Alabama and Mississippi rice brought 80c., and the two great rice-producing states of Louisiana and Texas followed in the order named; Louisiana rice brought 79c., and Texas rice 78c. The total farm value of the rice crop of 1909, on December 1, 1909, is placed at $19,341,000.

The Department's figures as to acreage and production in Louisiana and Texas are largely based on reports received from the farmers, mills and warehouses, and are largely accepted as being reliable. Figures on other points are doubtless correct, although the quoted prices for rice may be a trifle higher than those actually paid.

SUGAR CONSUMPTION IN THE ORIENT.

(From the *Louisiana Planter*, Vol. XLIV., No. 10, March 5, 1910.)

In the world's increase of sugar consumption, according to authentic reports, the vast population of the south-east quarter or section of Asia (with its outlying Island Empire), is beginning to cut an important figure. In that part of the globe China, with an area about as large as our United States exclusive of Alaska, contains according to census figures and general estimates, 400,000,000 people. The adjacent countries of Corea and Japan and the colonial territories of European nations would probably add 100,000,000 to that enormous mass of population. Hence there are half a billion people, or about one-third of the population of all the earth gathered in south-east and Eastern Asia.

Now here a little figuring might prove interesting. Supposing that the annual sugar consumption of the United States were 3,000,000 long tons (and it is a little over that), and that we have 85,000,000 sugar-eaters. That gives us a consumption of 80 lbs. per year. If those 500,000,000 Asiatics had as sweet a tooth as we, it would take 40,000,000,000 lbs. or about 18,000,000 long tons of sugar (which is more than all the world makes) to feed them.

Lying south and south-west of the land of the Mongols and the Manchus is British India, of nearly the same area with a population of 300,000,000. Now the Hindoos are and have been for centuries far ahead of the Chinese in sugar consumption. According to the most reliable information procurable, much of which has already been printed in the *Louisiana Planter* as matter from its East Indian correspondents, modern British India, composed mostly of ancient Hindoostan, is easily the largest sugar-producing country in the world. It makes annually about 3,000,000 tons of crude sugar, all of which is consumed at home, together with a comparatively small importation of refined sugars for its English population and the well-to-do among the natives. If the Hindoos and foreigners of British India ate proportionately as much sugar as the ruling nation at home, they would need every year 27,000,000,000 lbs. to feed them instead of the 7,000,000,000 lbs. they eat.

The production and per capita sugar consumption in Japan is not conveniently accessible to the writer of this article. The model government of Nippon has been recently wrestling with a national sugar trust built somewhat on the American plan, but possibly better, if such could be possible; and its treasury department has been for some time largely "at sea" in learning how much sugar has been received in the home ports and consumed by the people. Sugar-consumption is stated to be increasing there very rapidly; and in Formosa the cane sugar industry has been and is being extended as fast as possible through the great increase in the acreage under cane cultivation and the introduction of modern sugar mills and machinery from Europe and America.

Our Philippines colony makes about 200,000 tons or so of sugar, and what its people do not eat at home they sell to the Chinese and their latest conquerors.

Java, the Dutch possession, figures in commerce as the second cane-sugar-producing country in the world. In one or two crops it has exceeded Cuba, regarded as the first cane-sugar-producer; but in those instances abnormal conditions were prevailing in the great sugar isle of the Occident. The annual Java sugar crop runs along about 1,200,000 tons, which up to very recent years has been most largely sold to England and America.

Ex-Congressman Hawley and other high sugar authorities, state that now a considerable proportion of the Java sugar crop is turning towards China, Mr. Hawley says that it is because the 400,000,000 Chinese are at last learnning to take sugar with their tea. Here in parenthesis it would be well perhaps to note that the Russians who are the second tea-drinking nation in the world, have been slow to form the habit of taking sugar in theirs—we mean *tea*, not vodka. They make about and above a million tons of beet sugar at home every year; and, either from popular disinclination or through some bureaucratic hocus pocus that permits the Government and the manufacturers to divide a premium on export sugars, they do not eat it all at home. Think of a modern nation with a population double that of our American United States that cannot eat a pitiful little million tons or so of home made sugar. But there, perhaps as a matter of compulsion, the mujiks, who form an immense majority of the population, must exclude sugar from their daily rations of rye bread mixed with chopped hay.

Getting back to China we find that all of its enormous population must depend mostly on Java, with its annual crop of 1,200,000 tons, and the Philippines with

their maximum crop of 300,000 tons for their sugar supply to sweeten an ocean of tea and dry and preserve a world of fruits. In her war with Japan, about 15 years since, China lost her only isle of sugar, spices and camphor, Formosa, and now has no territory adaptable to cane-sugar-production. Her promoters and financiers in default of cane-sugar lands are proposing to start the beet sugar industry on an extensive scale in Manchuria and Mongolia. Manchuria is at present so overcropped with political issues that the beet sugar industry will be unlikely to flourish there some years to come.

Thus China (if it ate sugar or craved for it like the great American Republic nearly its size), which might eat 18,000,000 tons of sugar a year, has less than 2,000,000 tons of cheap sugar near at hand, available now or prospectively in the early future for all of its vast population.

Probably not before very long it will take all of the Java crop and all of the possible Philippines crop and eat up a sizeable beet sugar crop made at home. They are a conservative race, and from once being 5,000 years ahead of the times, appear to be half willing now to remain 5,000 years behind them. But within a living generation their conservatism has capitulated to modern steam and modern statesmanship, and even the Chinese peasantry is beginning to learn that refined sugar is at least as palatable and fortifying to the stomach as the roasted rats of the old legends.

There are propositions to follow in other home-governed cities the example of British ruled Hong Kong in the building of refineries. When that is done and Chinese capital develops the proposed beet sugar industry in some of the most adaptable and populous provinces, it is more than likely that a taste for that sweet, which has become a leading food-product of most other lands and races of the world, will be stimulated among the Chinese people, which must lead to a marvellous increase of consumption in that overcrowded land of the Orient.

When the uncounted and uncountable millions of the Chinese and Russian Empires learn to appreciate the value of sugar as a cheap and wholesome food, the political economists and industrial statisticians need never bother their brains about the world's possible or probably over-production of sugar for many a long year to come.

TIMBERS.

FORESTS OF THE GOLD COAST.

(From the *Kew Bulletin*, No, 2, 1910.)

The recently issued Report on the Forests of the Gold Coast by Mr. H. N. Thompson, Conservator of Forests, Southern Nigeria, demand careful perusal and attention since the general principles laid down are applicable not to the Gold Coast only but to tropical forests in general.

The Report occupies 238 pages, and is divided into three parts with an appendix, list of vernacular names, twenty-four plates and a comprehensive index.

In the first part the various forest areas of the Gold Coast are described in detail, the value of their component trees is discussed and suggestions are made for their preservation or exploitation. Mr. Thompson is careful to point out the prime importance of the Forest to the Gold Coast Colony, and brings forward many illustrations of the irreparable damage which is being done by the reckless felling of trees, in connection principally with clearings for native cultivation. Before making any detailed comments on the first part, the second and more general part of the Report may be considered. This is in some ways the most important portion and certainly the part of most interest to the general reader.

The importance of Forests is so well stated that the paragraphs relating to their effects on the physical and climatic conditions of a country are taken *verbatim* from the report.

"1. They mitigate extremes of temperature and render the climate more equable.

"2. They exert a marked effect in regulating the water supply more especially by ensuring the sustained feeding of springs and thus rendering the flow of water in rivers more continuous, and in tending to reduce the danger of violent floods.

"3. They increase the relative humidity of the air, and in consequence

reduce the amount of evaporation. This effect is strongly marked on hills in the tropics.

"4. By the mechanical action of their roots and stems the plants composing forest vegetation assist in preventing land-slip erosion of hill-sides, the silting up of rivers, and arrest the progress of shifting sands.

"5. They tend to increase the precipitation of moisture.

"6. They act as wind-breaks, and protect adjoining cultivated areas against the action of cold or dry wind.

"7. They act as barriers against the spread of fungoid and insect attacks from one cultivated centre to another.

"Almost all the effects are more pronounced in the tropics, especially in localities with well-marked wet and dry seasons, than they are in the temperate zone."

The regulation of the water supply is one of the most important and far reaching effects of forests in such a country as the Gold Coast. With the cutting down of forests a gradual change in the vegetation at once sets in, if such forest be well within the region of "Rain Forest" no very serious consequences may result, if, on the other hand, the forest area lies on the borders of the rain forest region the reckless cutting down of the tree vegetation will so alter the conditions that the character of the country will quickly change from that of rain forest to deciduous forest and finally to that of the Savanah country. The places once occupied by trees will be invaded by grasses, and as soon as they have established a footing the forest is doomed; the region become exposed to forest fires, the rainfall is not retained by the ground and the head waters of the springs, formerly receiving a constant supply of water from the damp forest-covered hill-sides, now obtain a torrential supply of water during the rains but are waterless during the dry season. The action of cutting down forest under such conditions not only may cause infinite harm in the actual region but may also cause much injury to areas far distant by interference with the proper water supply. Mr. Thompson points out that with the alteration in conditions on the forest the majority of the species of timber and other important trees confined to the moist evergreen forests disappear, and all such agricultural crops which depends on moist conditions, as cocoa, rubber, &c., will also suffer and their cultivation may ultimately become impossible.

It is clear, therefore, that the Forests of the Gold Coast and of our other West African possessions need efficient control and supervision.

Mr. Thompson deals very fully with this side of the subject and points out the lines which legislation might follow. The chief danger menacing the Gold Coast Forests is not their over-exploitation for forest produce but their wholesale destruction for farming purposes. It would appear, therefore, that any measures adopted for the "reservation" or "protection" of the forests should also be accompanied by provision for the instruction of the natives in methods of more intensive agriculture.

Mr. Thompson makes a very interesting and apt comparison between the forests of the Gold Coast and those of the Southern Shan States of Burma, and it is possible that the policy followed in the East might prove suitable for the conditions which obtain in West Africa. Of the arrangements suggested, perhaps the most important are those relating to forest taxes, the sale of timber, and the revenues derived therefrom.

In concluding this section on the protection of the forest, it is conceded that something might be done in the way of persuading chiefs to look after the forests, but it is only a method of chance depending on the influence of a few officials and is a slow process, "meanwhile the forests are being rapidly destroyed." It may confidently be asserted that no real progress has or ever will be made in Forest Conservancy unless the Supreme Government reserves to itself the right to direct and regulate its application. It is only the Government that can have the tenacity of purpose to carry the forests through the various vicissitudes and bring them into an organised condition capable of ensuring a sustained and increasing yield of produce in the future.

In the first part of the Report detailed information of the forests and of the condition of the country is given on which the general account of the second part is largely based.

The Aburi hill forests, situated on the edge of the Accra plains afford a useful but disastrous object lesson of the effect of removing the forest. Cassava farms, made by clearing the forest, when abandoned to lie fallow become occupied by grasses, and as the grass is burned every year the exposed soil is washed away during the rainy season and denudation of the hillsides begins.

The drying up of streams, which is also associated with forest destruction,

has actually occurred fairly recently in two instances near Aburi. In some cases the natives in clearing the forest leave some of the largest trees as standards, and on such grounds a tangled mass of vegetation springs up. Conspicuous among trees in such secondary growth is the "umbrella tree," *Mussanga Smithii*, which grows rapidly and has a dense canopy of leaves, and though the value of the forest as far as produce is concerned is lost, still the ground is not exposed to the dessicating action of sun and wind or to the force of the rain and the physical effects of complete forest destruction do not occur. The umbrella tree, however, has this disadvantage, that owing to its dense shade the growth of more valuable species is delayed.

At the commencement of chapter ii., useful information is given as to some of the more important timber trees, such as *Piptadenia africana*, *Triplochiton Johnsonii*, *Terminalia superba*, and of the shingle trees, the Khayas, *Sarcocephalus esculentus*, and others. Of the "Waw-waw" *Triplochiton Johnsonii*, Mr. Thompson remarks: "It is quite good enough in quality to replace the imported pitch-pine and it is extremely abundant; our West African forests contain sufficient supplies not only to meet large demands for it in the home markets, but also in the local ones."

Chlorophora excelsa, "Odoum," furnishes the best all-round timber in Tropical West Africa, it is plentiful in Ashanti; among other trees of first importance are the West African cedars of the genus *Pseudocedrela*.

The genus *Khaya*, the Gold Coast mahogany, is represented by several species; five are figures in the report. It is unfortunate that the species known as "Dubini" by the Fantis has not yet been properly determined owing to lack of sufficient material, since it is stated that the bulk of the Gold Coast mahogany is afforded by this species.

In addition to *Piptadenia africana*, a common timber tree, there is another species figured in the report under the name of *Piptadenia* sp., a timber tree of some importance and very prevalent in Southern Ashanti.

Since the publication of the report this species has been identified with *Cylicodiscus gabunensis*, Harms, a plant which was, until lately, very impefectly known. *Cylicodiscus* was originally described from flowering specimens collected by Soyaux in Gaboon and by Staudt in the Cameroons, whilst the fruits served for the basis of another new genus, *Cyrtoxiphus*, and it was not until 1906 that Harms recognised that the latter represented the fruiting condition of the former. The genus *Cylicodiscus* differs from *Piptadenia* firstly in the presence of a disc inserted between the stamens and the base of the gynophore, and secondly in the very long woody pods. *C. gabunensis* was also discovered in Southern Nigeria by Dr. Unwin and Mr. Foster, and its area extends evidently throughout the greater part of the West African forest region.

A good timber which also yields a first-class fuel is the "Kokoti," to which the name *Pynærtia ealænsis* is given in the report. A note on this tree appeared in the *Kew Bulletin*, 1909, pp. 309-312, in which it is shewn that this tree, a member of the natural order *Rhizophoraceæ* should be referred to Engler's genus Anopyxis and should bear the name *Anopyxis ealænsis*.

Mr. Thompson points out the wealth of the Ashanti forests, which contain large quantities of Pseudocedrelas, Khayas, Funtumias, and other valuable trees. He is of the opinion that a special effort should be made to protect these forests and bring them under organised control. It is perhaps fortunate that at present the mass of this forest area is not easily accessible.

Of these forests in general he remarks: "I think that in number and variety of valuable trees these extensive forests of Western Ashanti will be hard to match anywhere in Africa. Moreover, the undergrowth is not so dense as that prevailing in evergreen forests to be met with near the coast, and in consequence the natural generation of the more important species is far more satisfactory and the gaps in the various age gradations less pronounced.

The Savanah forests of North-Western Ashanti appear to be in greater need of forest conservancy in some ways than the forests of the moist regions, since they form the belt between the open grass land and the country where there is greater moisture. It is in this region of mixed deciduous forests that fire protection is an essential feature of any conservancy programme. The timber in this region is also valuable, including such trees as *Khaya senegalensis*, the "dry zone" mahogany, *Afzelia africana*, and the "dry zone" cedar, *Pseudocedrela Kotschyi*, all suitable for the home market. As mentioned before, the proper preservation of such forest areas as these is intimately bound up with far-reaching questions of water supply.

In discussing the question of reserved areas Mr. Thompson lays stress on the necessity of reserving the forests cloth-

ing the *crests of the hills* and the *steep slopes* from the operations of the farmer on the general grounds of preserving the climatic conditions that are of most value to the country.

When discussing the dry open country of the Afram plains (Report, pp. 84-92) some useful information is given as to the various plants and trees of this region from which it appears that the list of useful plants is one of some length and includes plants of considerable value.

A few remarks on the subject of game and game laws are of interest and deserve attention. It is pointed out that whilst Europeans are obliged to take out licenses and are restricted as regards the shooting of certain species, no steps whatever have been taken to limit in any way the incessant slaughter carried on by the natives. The European's bag is as nothing compared with the annual bag of the native, and game preservation at present is a failure. The hunting class appears to be composed of those who were formerly the fighters and now, owing to peaceful times, having been deprived of this employment, have taken to the chase of wild animals with renewed energy.

In conclusion, it may be pointed out that the problems confronting the Gold Coast Colony with regard to its forests are difficult and serious, since the preservation of the evergreen forests, on which the water supply so largely depends, and of the deciduous forests forming a belt against the Savanah Country, is at stake, and with this is bound up the general character of the agricultural operations of the Colony. The most pressing need in connection with forest conservancy is the prevention of the wholesale destruction of the forest for farming purposes, in comparison with which the accumulated effect of timber exploitation is stated to be "a mere bagatelle."

GLIRICIDIA MACULATA.

(From the *Agricultural News*, Vol. IX., No. 203, February 5, 1910.)

An account of a new use for the Nicaraguan shade tree (*Gliricidia maculata*) is given in No. 61 of the *Bulletin of Agricultural Information*, Trinidad. It consists in cutting off such parts of the branches as may have grown sufficiently to extend below those of the cacao trees which it protects, and using them as a mulch. Such material should form a valuable addition to the matter that is available for mulching in cacao orchards

PLANT SANITATION.

THE DISEASES OF CACAO.

BY T. PETCH.

[Die Krankheiten und Parasiten des Kakaobaumes. F. C. VON FABER. Arbeiten der Kaiserl. Biologischen Anstalt.]

To anyone who studies the literature relating to cacao diseases, the most striking feature of it is the paucity of records of scientific investigation, though the diseases have been known to exist for at least a dozen years. Howard showed the way with a full account of *Diplodia cacaoicola* in 1900. After that, there is a gap until 1908, when F. C. von Faber published an account of the "Witches Broom" disease in Surinam, together with some details relating to cacao "canker." This was followed, in 1909, by a very complete and excellently illustrated paper on the "Krulloten ziekte" of Surinam by C. J. J. van Hall and A. W. Drost, and a similar paper on *Diplodia cacaoicola* by A. E. van Hall and A. W. Drost from the same country. Surinam has now taken the foremost position in the investigation of cacao diseases, and its reputation has been recently enhanced by the publication of a paper on cacao "canker," by A. E. van Hall, which fully maintains the high standard set by the contributions previously referred to. This last named paper has already been summarised for the *Tropical Agriculturist*.

F. C. von Faber has now collected all the available information relating to the diseases and insect pests of cacao, up to 1909, and has published a beautifully illustrated work, giving a full summary of the records of previous authors as well as details of his own investigations. The material has been carefully summarised, and the only possible objection that can be raised is that the author might in some cases have been more critical. From the point of completeness, it is unfortunate that several valuable contributions should have appeared almost simultaneously with its publication.

One peculiar feature of the diseases of cacao was that, according to the published accounts, what were apparently the same diseases were caused by entirely different fungi in different countries. This is now being abundantly disproved, and it is becoming more and more evident that these apparent differences are based only on errors, either of observation in the field, or of identification of the fungi in the laboratory.

The common pod disease is now universally attributed to *Phytophthora*, a species which has been named *Phytophthora Faberi*. Von Faber agrees that it is always worst in damp situations. This is in agreement with the results obtained on the Experiment Station, Peradeniya, where a striking decrease in the number of diseased pods followed the removal of the dense shade. The following figures give the number of trees per acre, cacao and others, and the percentage of diseased pods from 1902 to 1906 :—

	Cacao.	Others.	Fungus pods.
1902 ...	330	178	38·6
1903 ...	252	77	8·8
1904 ...	246	71	4·8
1905 ...	328	440	2·5
1906 ...	330	450	10·2

The "other" trees in 1902 were large Albizzias, Jak, etc. The increase in the cacao in 1905 is due to supplies, and in the "others" to dadaps which were planted in 1904; the additional trees were therefore small in 1905. The whole of the cacao pods were sprayed, during August, in 1905 and 1906, but in spite of this there is a marked increase in the percentage of diseased pods in 1906 when the dadaps had grown taller. Seeing that an equally marked reduction followed the reduction of shade in 1902-03, though the trees were not sprayed, is it incorrect to attribute the increase of diseased pods in 1906 to the fact that the estate had become a jungle of dadaps? There was a heavy rainfall during October, 1906, and this increased the percentage of diseased pods for that month, but on the other hand, the total rainfall for the year is practically equal to that of 1905, so that the remainder of the year must have been drier. Yet the percentage of diseased pods during 1906 is greater than that during 1905 for every month but two. There can consequently be no other conclusion than that the increased percentage of diseased pods was due to the increase of shade and consequent increase in humidity.

Von Faber recommends spraying with Bordeaux mixture as a preventative against pod disease, and quotes the result of an experiment in the Cameroons in which the unsprayed plot bore 56 per cent. of diseased pods, while the sprayed plot bore 22·24 per cent. This result is not so favourable as those quoted above, where the only treatment consisted of the removal of shade and the periodic collection of diseased pods. He advises the addition of resin and starch to the Bordeaux mixture, and states that it is not then washed off the tree by the heavy rain; this advice is contrary to the belief of other experimenters, viz., that no addition to Bordeaux mixture increases its adhesiveness. He very rightly insists that all diseased pods should be periodically collected and the shells destroyed. There is no doubt that this is most important, even more important than spraying. The disinfection of diseased shells by means of Iron sulphate is quoted with approval.

The Witches Broom disease of the Cameroons and the somewhat similar "Krulloten" disease of Surinam are fully described, but as these do not occur in Ceylon, they need not be further referred to here.

The "canker" disease of the Cameroons is identical with that in Ceylon and Surinam. It is to be expected, therefore, that the stem disease of the West Indies will prove to be the same, though from the descriptions given it appears different. Von Faber gives descriptions of ten species of *Nectria* which have been found on diseased cacao, and even then he has missed one, *Calonectria flavida*. He was not able to carry out infection experiments with the *Nectria* found in the Cameroons, and, as in all other cases, it is doubtful whether this is the cause of the disease. No one has yet been able to produce "canker" in a cacao tree by artificial infection, by experiments which are obviously open to most serious objections. Von Faber inclines to the belief that there is a *Nectria* disease of the pods as well as a *Nectria* disease of the stem, but there is not much doubt that the *Nectrias* observed on the pods are saprophytic, and it is doubtful whether they are more than this on the stem.

The Ceylon method of excising the diseased tissues is recommended, but in addition von Faber advises that the wounds should be covered with tar. Carbolineum proved unsuitable for use in cacao. Thinning out the crowns of the trees is also advised. Von Faber

refers to Wright's advice *re* the use of Bordeaux mixture against canker. Wright's advice, however, was based on a misapprehension of the nature of the diseases he was treating; he adhered firmly to the belief that the pod and stem diseases were identical, and therefore imagines that in spraying the pods he was combating the stem disease. As the two diseases are different, his results with Bordeaux mixture are not relevant to canker. However, the results quoted by von Faber, viz., a diminution in the number of cankered trees from 96 per cent. in 1902 to 4·3 per cent. in 1904 were obtained before the estate was sprayed. They can only be attributed, therefore, to removal of shade and excision of diseased tissues. Similarly, the results of the work against pod disease from 1902 to 1904, illustrated by Wright's diagrams, are to be attributed to the removal of shade and the regular collection of diseased pods, not to spraying.

The section dealing with *Diplodia* illustrates the confusion which has arisen through the transmission of disease specimens to Europe. Nine pages are devoted to the discussion of the several species which have been found on cacao. But recent researches have shown that these are all the same species, and that, in general, it is only saprophytic! When twigs have been killed by exposure to the sun, or by *Helopeltis*, *Diplodia* may act as a wound parasite, and, after growing on the dead twig, may attack the still living part of the branch and kill it further back, but only in this case is it known to cause damage.

It is interesting to note that the damage which is attributed to squirrels in Ceylon is attributed to rats in other countries. In the West Indies it has been claimed that spraying the stem with Bordeaux mixture keeps away rats, but it is difficult to understand how this could be effective if the branches of adjacent cacao trees touched one another as they usually do.

One is rather surprised to find in the third chapter an account of a Peradeniya experiment which proves the advantage of a wind-belt. It is published on page 66 of Wright's book. The result is as follows, the numbers being the number of fruits per acre.

		Without wind-belt.	With wind-belt.
1903	...	1,275	2,463
1904	...	2,942	5,268
1905	...	4,023	6,430

The experiment was proposed in 1903, and the wind-belts were to be planted in October of that year. The figures for 1903, therefore, merely give the original condition of the plots. The average number of fruits per acre for the whole estate was, in 1,903, 2,322; in 1904, 3,796; and in 1905, 7,117. The plot without a wind-belt was therefore much below the average, and it would have been better if two more equal plots had been chosen. It may be noted that the wind-belt plot drops below the average in 1905. From the report for 1903, it appears that eight wind-belt experiments were planned. The trees selected for the different belts were *Grevillea robusta*, *Michelia champaca*, *Pterocarpus echinatus*, *Eugenia jambos*, *arecanuts*, *Filicium decipiens*, *Castilloa*, *and Erythrina lithosperma*. Each was to be planted in the form of a square, 40 yards by 40 yards, and all shade trees and palms within 75 yards of a square were to be removed. The 1904 report gives no further information, except that it is stated that the number of *Michelia* on the estate is due to the newly-planted wind-belts; and there is nothing about them in the report for 1905. There are no records which would inform us which of these wind-belts provided the figures quoted, or where they were situated. It is probably a mere coincidence that 2,463 is the crop of plot 33 in 1903, and 5,268 is the crop of the same plot in 1904, since its crop for 1905 is not 6,430, but 8,088. The control plot selected in 1903 was No. 44 (5 acres); it was to be cleared of everything except cacao, and the 1903 report states that "already it has become a congested centre of troublesome weeds." Apparently it was not subsequently kept as a control plot, for in July, 1904, it bore, in addition to the cacao, 93 coconut and areca palms, and 74 other trees, and in July, 1905, 85 coconuts and areca, 1,577 dadaps, and 40 other trees. Its crop for the three years under discussion was 12,756, 18,480, and 36,471 pods.

The experiment is not included in a list of experiments in progress furnished to the Committee at the beginning of 1906. Apparently it was abandoned at the end of 1905 and the trees removed; consequently it is not possible to furnish figures for other years, nor to say where the plots were. But it is obvious that trees planted in October, 1903, could not have afforded an efficient wind-belt for old cacao in either 1904 or 1905; hence whatever may be the value of the figures they do not represent the advantage of a wind-belt.

It may further be noted that on the plot with the wind-belt the increase in 1904 is 114 per cent., and in 1905, 22 per

cent.; but on the plot without a wind-belt, the increase is 131 per cent. in 1904 and 37 per cent. in 1905. *Hence the improvement is greatest on the plot without a wind-belt.* Both plots are much below the average of the whole estate for 1905, viz., 7,117 pods, though of course the rest of the estate had no wind-belts. Another point which must be taken into consideration is that the method of counting the crop by the calendar year gives as real information about the annual improvement of a given plot. For the crop year is from June to June, and the heaviest yielding months are about the change of the calendar year; consequently one calendar year may have only two main crop months, while the next calendar year may have four. The latter may then appear twice as good as the former, although the actual crops are really equal. Unfortunately it is not possible to correct the figures of the experiment quoted above, since the numbers of the plots are unknown.

THE MISTLETOE PEST IN THE SOUTH-WEST.

(From the *U. S. Department of Agricultural Bureau of Plant Industry, Bulletin* No. 166.)

SUMMARY.

(1.) In general, the American mistletoe, like its European prototype, is more cherished because of its biologic interest and historic setting than feared for its harmfulness to trees. In some districts, however, notably in Central Texas, its destructiveness as a tree parasite outweighs other considerations in its behalf.

(2.) The region in which mistletoe is most destructive coincides with the transition from a humid climate favourable for forest growth to a dry climate less favourable for trees, and where the effects upon tree growth are such as to furnish the parasite more favourable light conditions than in the closer stands and denser foliage of humid climate forests.

(3.) The harmfulness of mistletoe is due in part to its mechanical injury to trees (deformity of branches and trunk, wounds followed by decay), but more especially to its drain upon the trees' vitality by withdrawing water and nutriment substances from them. The sinkers which connect the parasite with the water-transporting vessels of the wood and the cortical roots which ramify in the soft bark are the means by which the parasite withdraws substances from its host.

(4.) The first infection of a tree by mistletoe takes place only through the agency of a germinating seed placed upon the body or branch of a tree by birds (mostly mocking birds, wax wings or cedar birds, and robins), except in the rare case where berries fall upon a branch from a bunch of mistletoe in an overtopping adjacent tree. The subsequent spread of infection upon a tree may take place by the falling or washing of berries upon other parts of the tree from the previously established mistletoe shrubs, or by the spread of cortical roots from which new mistletoe shoots arise. Spreading by cortical roots occurs more readily upon some species of trees than others, and is especially stimulated by the injury or removal of the original shoot.

(5.) The mistletoe seed and seedling exhibit unusual powers of resistance to drying out, and are thereby enabled to survive in considerable numbers the critical period from the time the berry is placed upon a branch until the parasite plant becomes established. This period may extend beyond the first growing season.

(6.) A tree may become infected at any point where living tissue is exposed or covered only by a thin layer of cork with breathing pores, but the most vulnerable points are the young branches and sometimes buds. The sinker of the mistletoe seedling is able to penetrate certain tissues by dissolving the walls of cells living in its path. It is uncertain whether cutinized or corky cell walls can be so dissolved, but the writer believes that they can.

(7.) The trees most liable to infection are those which occur singly or in clumps or rows along streets and highways, in vacant lots and parks, along the border of fields, and narrow strips of timber along streams. The damage to trees in forest stands is negligible. Shade and ornamental trees suffer most.

(8.) While it is not certain that any broad-leaved tree is wholly immune to attack from the American mistletoe, some are practically so, although freedom from infection seems to vary with locality. In the choice of trees for planting the question of the ability of a tree to resist infection might profitably be considered. It is believed that any tree subject to infection may be infected by seed from mistletoe growing upon any other species; *e.g.*, the hackberry may be infected by seed of mistletoe grown on the elm, the live oak from those on the mesquite, etc.

(9.) The damage to trees may be very largely overcome by breaking and scraping off the bunches and scattered sprouts of mistletoe every year or two. If the parasite is attached to small branches these may be pruned off a few inches below the mistletoe, and thus the infection be wholly removed at that point.

(10.) Infection upon old branches and upon the trunk is very difficult to get rid of, because the cortical roots spread freely in the soft bark and any piece left there may give rise to new mistletoe sprouts. Since the cortical roots do not extend into the wood (of course sinkers do), the removal of the hard and soft bark clean to the wood about an infected spot should exterminate the parasite at that point. The objection to this method is that it necessitates large wounded surfaces. Such wounds should always be disinfected and afterwards coated with tar.

(11.) In some cases mistletoe has been killed from old branches by the application of chemicals, which is made more effective by subsequently wrapping the limp with burlap. Thus carbolineum alone, and asphalt paint with burlap wrapping, were found to eliminate the infection.

(12.) It is suggested that a combination of the above methods would be effective. First, remove with gouge or chisel the exposed shoots or buds of mistletoe down to the wood without making large wounds; fill the larger wound holes with tar, and paint the whole surface with carbolineum or with asphalt paint. When asphalt paint is used wrap afterwards with burlap.

(13.) The cutting off of large branches in order to get rid of mistletoe is to be discouraged. It is apt to injure a tree more than the mistletoe would, particularly if the latter be broken or scraped off every few years.

(14.) Every wound on a tree, *e.g.*, those caused by digging out mistletoe or by cutting off branches, is a point of attack for disease-causing germs. Such wounds should always be disinfected and painted with tar or some similar waterproofing coating.

(15.) The mistletoe question resolves itself largely into the question of the care of trees. The spoiling or killing of trees by mistletoe is due chiefly to neglect. A well-organised movement in behalf of civic improvement would help to remedy this defect. City and county officials who have charge of streets and parks and public highways should be required to see that trees on public ground are kept free from mistletoe.

(16.) The use of the mistletoe in Christmas decorations gives it a commercial status which has some bearing on the question of its control and extermination.

APICULTURE.

CONVERSATIONS WITH DOOLITTLE.

Differences in Colonies.

(From *Gleanings in Bee Culture*, Vol. XXXVII., No. 1, January 1, 1909.)

"Mr. Doolittle, I believe I have the poorest strain of bees in the world, and I want you to tell me how to get rid of them and to get some that are first-class. Can you do this?"

"Certainly. Kill those you have and purchase such as you would like."

"But that is not just the answer I wanted. I know that such a course would be all-right; but is there no way of changing from the poor strain to one which is first-class without killing those I now have?"

"Yes. But why do you say you have the poorest strain of bees in the world? Have you tried all the different strains which now exist? Have you tried all that exist in the United States, even?"

"No, I have tried none but those I now have, which came from a colony I purchased at an auction three years ago. Perhaps I was rash in my expression; but the larger part of my colonies do very little, while one, especially, has given me good returns the past two years. Now, if I could only have all my colonies equal to this good one I should feel quite proud."

"But the good one must have come from the original colony you purchased at the auction, and this shows that there is a marked difference in bees as to their working qualities. But it seems to me that your trouble is a case of selection rather than the adoption of an entirely different strain of bees."

"But why should this colony show such a marked difference from the other four? I have only five colonies in all,

and this one gave me a greater surplus than the other four combined."

"The difference in the industry of certain colonies of bees has often been a surprise to their owners; but during a careful investigation for years, certain facts came to light which have enabled the careful and practical apiarist to overcome this matter to a great extent."

"Now you are getting at just what I want to know. How can this difference be overcome?"

"One of many great things having a bearing on this matter is breeding. The importance of breeding from our very best colonies is great, and is becoming better understood as the years go by; and the bee-keepers of America stand in the foremost ranks of the world on this particular question."

"Yes; but how is it done? Take my case with one good colony and the four poor ones for an illustration."

"Next year you should rear all your queens from the one which heads that best colony, and, as opportunity offers, have every colony you possess headed from queens reared from her."

"But do you think this colony as good as there is in the world?"

"It should not be, if your first talk about your bees had even a grain of truth in it. The one colony in two years' time, with no attention paid to breeding matters, could not be as good as some colonies headed by queens from those who have spent five, ten, fifteen, and twenty years in bringing their best colonies up and up till they stand at the very head of the list in the United States, or as nearly up to perfection as seems possible at the present time. There are a score or two of breeders in the United States to-day, who, in all probability, have bees as much ahead of those you have as yours are ahead of those found in their native haunts, where the uplifting touch of man has had nothing to do with them."

"Then why do I not kill all of mine off, as you at first suggested, and start anew?"

"Because it would be an unnecessary waste. Buy a queen, or a colony of bees, from some one of the breeders you have confidence in, and from such a purchased queen rear queens next season until you have one to head each of the colonies you may have in the fall of 1909. Or, perhaps, it might extend your vision and prove a benefit to you to keep the queen in your best colony, rearing one or two queens from her as well, and see how they will compare with those reared from your purchased queen."

"I begin to see now, and I thank you very much. But you spoke of certain facts which had to do with this matter as though breeding had not the whole to do with it. What are some of the others?"

"A beginner, like yourself, is often impatient for increase, and much increase means little honey, except, perhaps, from some first or prime swarm, or from some colony which is made just right, and at the right time in the season. All of the others are crippled on account of a lack of bees, or a lack of the proper number of bees in just the right time to take advantage of the flow of nectar which gives a surplus in your locality. In such a case, the beginner, with the best bees in the world (or even a man who has kept bees for years, but paid no attention to these things), would find himself in almost the same condition you have been describing to me about your two years' experience."

"I begin to understand; for the colony which has done so well for me was a prime or first swarm, as I call them, a year ago last summer, and this summer it did not swarm at all."

"Then in wet seasons bees generally get just enough nectar to stimulate breeding, which gives large numbers of bees, with hives crowded with brood and very little if any honey in the sections, except, perhaps, with some colony which comes up to the harvest in just the right condition so it does not incline to swarm, when, with only two or three days of a good nectar-flow, such a colony or such colonies will give a surplus, while those that incline to swarm will give none. Results in such cases devolve more largely on the management of the apiarist than upon the strain or quality of the bees. I admit that there are poor bees, but I know that quite a few of our most practical apiculturists of the present time believe that there are lazy bees, or those which have been bred so closely for colour or some other desired point that their usefulness is very largely crippled. However, we can show that the fault is not altogether with the bees, when fifty to five hundred colonies accomplish little or nothing during any season, for close study will tell us that the season is a poor one; that our locality is overstocked, or that we as apiarists are not bringing every colony to the point where it is ready to take advantage of one or more flows of nectar when they come."

SCIENTIFIC AGRICULTURE,

NATURAL STERILISATION OF SOIL.

(From the *Gardeners' Chronicle*, Vol. XLVII., No. 1211, March, 1910.)

As our readers are aware, experiments carried out by Messrs. Russell and Hutchinson at Rothamsted have thrown an entirely new light on the origin of the enhanced fertility brought about by soil-sterilisation. That soils sterilised by heat or by certain poisons such as carbon-bisulphide yield larger crops than similar unsterilised soils has been demonstrated by various observers. A full account of the explanation, given by the authors just referred to, of the mode of action of the sterilising agent was published in these columns on October 23, 1909. Briefly, it amounts to this, that heat or poisons kill out those organisms, such as amœbæ and infusoria, which normally prey on the soil-bacteria. Certain of the soil-bacteria are also destroyed. Those which remain have the field to themselves, and hence increase and multiply exceedingly. In the absence of competing organisms, the supplies of nitrogen-compounds in the soil are the more available for the crop, which, in consequence, flourishes more abundantly in the sterilised soil than in one in which occur multitudes of organisms all hungry for nitrogen. The nitrogen compounds of the soil go into the plant instead of being shared between the plant and the teeming "population" of the soil. An interesting application of this sterilisation hypothesis is made by Messrs A. & G. L. Howard in a recent issue of *Nature*.

It appears, according to these authors, that the Indian ryot has practised a kind of summer fallowing or weathering from time immemorial. During the months of April and May he exposes the alluvial soil of the Indo-Gangetic plain to the burning sun. Where the soil is light it is ploughed by means of the native wooden plough; where it is heavy, it is, however, not worked—owing, apparently, to the lack of suitable tackle—until the arrival of the monsoon rains.

The effect of the exposure of the worked, light soil to sunlight is remarkable, the beneficial result on the succeeding crop being equal to that which would be obtained by the application of nitrogenous manure. Messrs. A & G. L. C. Howard suggest that the effect of the intense sunlight is to partially sterilise the soil, and thus to induce in the soil similar changes in micro-flora and fauna as are effected by artificial sterilisation. Thus, if we accept this explanation, the summer weathering has precisely the same effect as a dressing of nitrogenous manure, in that it renders nitrogen compounds available to the crop. The destructive action of sunlight on bacteria has been demonstrated experimentally, and is, of course, exploited constantly by thrifty housewives, as, for example, in exposing bedding and other household effects to bright sunshine.

The detailed effects of sunlight on soil bacteria have not yet been investigated. We may predict confidently that results of the greatest practical importance will be obtained from such investigations. It is, at all events, probable that the secret of the origin of the nitrate beds of S. America, whence are derived the bulk of our supplies of nitrate of soda, is bound up with the partial sterilising effect of sunlight.

Nor is it at all impossible that the soil lying in the deep shade of trees might not be ameliorated by sterilisation. Anyone who has the opportunity might well try the effect of sterilising such soils in which little will grow, by means of copious waterings of carbolic acids or permanganate of potash, and then determining whether grass and other plants would not succeed better than in similar unsterilised soils. Of course, it is not suggested that shaded soil so treated will become fully fertile, for evidently sterilisation cannot serve a plant in lieu of sunshine: nevertheless, it is probable that some amelioration might be effected. In any case, the investigation of the bacterial flora of the soil, which is bound to be of no small service to horticulture, should receive a powerful stimulus from the work of Messrs. Russell and Hutchinson.

AGRICULTURAL CHEMISTRY.

(From the *Chemist and Druggist*, Vol. LXXVI., No. 1566., January, 1910.)

In the current number of the "Board of Agriculture Journal," there is a paper by Mr. E. S, Salmon, F.L.S., Mycologist to the South Eastern Agricultural College, Wye, Kent, on "The Making and Application of Bordeaux mixture." This subject is dealt with in the *Chemists' and Druggists' Diary*, 1910, but it is useful to emphasise anew some of the points referred to in Mr. Salmon's paper. The Bordeaux recommended for spraying fruit-trees is of the strength known as 4-4-50 (Imperial), and the importance of using wooden vessels is urged. The mixture should always be freshly made, as it is diffi-

cult to keep the gelatinous precipitate in suspension if more than a day old. A method of using stock solutions is outlined, and there are illustrations of the mixing apparatus, but these do not present any practical difficulty to a pharmacist who bears in mind the fact that the best precipitate is produced by mixing the copper-sulphate solution and the milk of lime when both are diluted to the utmost the strength of the mixture allows. If the Bordeaux mixture is properly strained no trouble will subsequently arise from blocking of the spray-nozzles. In speaking of the test of copper in Bordeaux mixture, we note that Mr. Salmon parenthetically refers to potassium ferrocyanide as a poison. It is not usual to designate those chemicals as poisons that are administered in doses of 10 grains. No additions should be made to the Bordeaux mixture, treacle and soap sometimes used being unnecessary. Mr. Salmon objects to powder and paste forms of Bordeaux mixture, as the resulting liquid settles much quicker than when the chemicals are combined in dilute solution. The production of a ready-made form of the mixture that would be free from this objection is worth investigating, as, no matter how explicity the directions are given for making Bordeaux mixture, the number of farmers who are able to carry them out successfully is small. With the spread of scientific knowledge among agriculturists this difficulty should disappear. The article deals exhaustively with the spraying-machines and nozzles with which Brodeaux mixture is used. The spray produced must be very fine and "misty" or smoke-like: a hanging "mist" or "fog" must be produced, which drifts over and through the tree, and deposits on the surface of the leaves excessively minute drops, which when dry give the parts of the trees that have been sprayed the appearance of being almost uniformly covered with a very thin bluish film or dust. Such a deposit is so intimately attached to the surface of the leaf or fruit that it does not readily wash off. The points to be considered about spraying-machines are (1) the machine and its chief working parts must be made of material which the spray solution will not affect chemically, (2) the pump must be powerful enough to maintain a pressure sufficient for the particular nozzle used, and (3) the build of the machine must be suitable for use in the particular plantations or orchards to be sprayed. Many agricultural chemists already undertake sheep-dipping or supply the apparatus for the work. We see no reason why chemists should not in like manner specialise in tree-spraying apparatus or undertake the operation of freeing or protecting fruit-trees from agricultural pests.

BARBADOS: REPORT OF THE AGRICULTURAL WORK.

GENERAL CONCLUSIONS.

(From the *Barbados Report of the Agricultural Work for the season between 1905-1907, Imperial Department of Agriculture, West Indies.*)

From the preceding summary the following conclusions may be drawn from the results of this year:–

(1.) The average yield of canes was a fairly good one being 31·94 tons for the whole field.

(2.) An ordinary application of farmyard manure without the addition of artificial manures produced a crop of 23 tons of cane per acre.

(3.) This crop can be substantially increased either by a further large application of farmyard manure or by the application of artificial manures.

(4.) The application of 20 tons extra of farmyard manure gave an increased yield of about 8 tons of cane per acre of the value of $24·00.

(5.) The most favourable result of the application of artificial manure was given by the plot that received 80 lb. of phosphate as basic slag in January, potash 60 lb. as sulphate in January and nitrogen (as sulphate of ammonia) 15 lb. in January, and 45 lb. in June. This plot gave about 40 tons of cane per acre, an increase of about 17 tons of cane by artificial manure. The value of this increased yield was $51·00, the cost of manure was $15·36, and the net profit $35·64 per acre.

(6.) Minerals alone (80 lbs. of phosphate as superphosphate and 60 lb. potash as sulphate, applied in January) gave an increase of 6 tons of cane per acre; but the results of the phosphate series and potash series leave it doubtful as to whether this increase is due to the phosphate or to the potash.

(7.) The application of nitrogen in addition to minerals gave an increased yield; 40 lbs. nitrogen as sulphate of ammonia applied partly in January and partly in June gave an increase of 3 tons canes. Net profit by the addition of nitrogen $2·52. An application of 60 lbs. nitrogen as dried blood partly in January and partly in June gave an increase of about 6 tons of cane. Net profit by the application of nitrogen $8·28.

THE COLOUR OF BLACK COTTON SOIL.

BY H. E. ANNETT,
Member, Department of Agriculture, India.

(From the *Chemical Series*, Vol. I., No. 9, March 1910.—Abstracted by J. C. WILLIS.)

The black cotton soil of India is the second most important soil of the country and covers at least 200,000 square miles. After describing the experiments in detail he comes to the conclusion that the black colour is mainly due to the presence of several per cent. of titaniferous magnetite and 1-2 per cent. of soluble humus. The soils are not rich in organic matter judged from the European standard. The amount of clay is exceptionally high, and accounts for the cracking that occurs in hot dry weather.

These black cotton soils occur over considerable areas in the north of Ceylon.

WATER REQUIREMENTS OF CROPS IN INDIA.

BY J. W. LEATHER,
Member, Department of Agriculture, India.

(From the *Chemical Series*, Vol. I., No. 8, January, 1910.—Abstracted by J. C. WILLIS.)

By means of pot cultures, answers were sought to the questions: "How much water is transpired by our field crops?" and "During what period does the crop require the principal portion of this water?"

Among the most important conclusions reached are that in suitably manured soil the amount of transpiration is reduced by one-third, that good tillage (as we have for years preached in this country, where tillage is nearly unknown outside of the Tamil country and the planting districts) and a deep soil reduce it also, and that in general the longer lived crops have a higher ratio of transpiration than those which mature rapidly. The amount of water transpired also rises rapidly when the plant begins to shoot, and remains high till near maturity, when it falls again rapidly.

EDUCATION.

THE PROBLEM OF AGRICULTURAL EDUCATION.

1. THE ESSENTIALS OF EDUCATION.

(From the *Agricultural News*, Vol. IX., No. 205, March 5, 1910.)

One of the greatest advances in educational matters was made when it was realised that the conditions of life had so changed, and the work that had to be done every day for the people of a country had become so specialized, that it was no longer feasible to educate its inhabitants according to one broad plan, the methods of which should be generally applicable to all of them. The increase of population, for one matter, had made it necessary that the things required for the daily life should be produced on a large scale, by the aid of machinery, rather than by individual craftsmen, and the cheapening of the products of the new mode of manufacture, together with the improved conditions of living, had again reacted by bringing about a state of affairs that further favoured the tendency for the population of a country to increase at a greater rate than that which had ever obtained before. Competition became keen, and it was seen that education must no longer be simply a matter of general preparation for living as an adult, and of the provision of means for inculcating the principles of discipline, but that it must be conducted, for each individual, in a manner which had definite relation to that part of the world's work to which his energies would be devoted ultimately.

The first effect of the realization of this fact has been to cause much stress to be laid on that side of education which has for its object the production of technical efficiency. There has been, in fact, too great a tendency to give instruction, and to leave out most of that which includes the essentials of true education. The result has been the production of schemes which went little further than to devise means for imparting knowledge, so that, in relation to all that is meant by education, no real

advance was made on the old system. Under the former conditions, the individual attained to a wider experience, and little interference was made with the chances for his later specialization, while the new method limited him from the first, and did less to provide him with the means of liberally enjoying his leisure. Another result has been that whatever has had relation to the more mechanical arts and crafts has been fostered, to the comparative neglect, until recent years, of the claim of the agriculturist to be fitted in the best possible way for the work which is to be his through life. Perhaps this late recognition of such a claim is not without its advantages, for it has come at a time when it is continually realised to a greater degree that mere instruction is not education, and that the aim of those who have the framing of schemes for education in their hands should not be the training of individuals to be merely capable of doing a certain thing in a certain way. Such schemes should, on the contrary, bring out the mental energies of those individuals, so that they may be able to appreciate the true inward meaning of what they are taught, and to attain that mental independence which will lead to critical consideration of the work of others, while giving them the capacity usefully to extend the scope of their own.

The West Indies share with all other tropical countries the circumstance that their interests are essentially agricultural. Their usefulness to the rest of the world must lie in the fact that they possess the conditions which enable them to produce, for the non-tropical zones, indispensable articles of food, clothing and shelter. It must therefore be patent that the education of the inhabitants of this part of the world must have special reference to the interests of agriculture. This cannot mean that the standard of that education should be inferior to that of the dweller in countries where the chief occupation is the treatment of raw material, so that it may become more directly applicable to the uses of man. The agriculturist, as a matter of fact, has the means of true education closer to hand than the follower of any other kind of occupation. He is face to face with the direct results of the forces of nature. He is met with the responsibility of attaining a state of mind that can devise means of gaining a knowledge of those forces which will enable him to direct them in such a way as to be of the greatest value to mankind. Finally, to this end, he is provided with opportunities of observation and experiment which are without equal as a means of broadening his mental sympathies, and thus giving him the manner of true education. With these advantages, there should be no difficulty in making agricultural teaching and practice as efficient as those of any other branch of knowledge. It will supply a mental training that will produce the individual who takes a living interest and pride in his work, the more so as it provides him with a means of realising that he is no longer the slave of routine, but the possessor of powers to originate and modify methods of procedure in ways which form the reflection of his own personality.

There are three broadly differing sets of circumstances under which instruction, either of an agricultural nature, or leading to this, must be given. These obtain in the primary school, in the secondary school, and, in the case where an agricultural training is continued after the pupil has reached an age when there is no longer any necessity for him to be subject to school discipline. In the primary school the teaching will never be of a directly agricultural character, it will, rather, be of the essence of nature study, in order that the most useful and immediately applicable means of education may be employed, and that the mind of the pupil may become of use to him in the work that he will be called upon to do when he leaves school. The idea of nature study will obtain as well in the secondary school, but its scope will be widened, and it will show a closer connection with the requirements of practical agriculture. In the case of a boy who goes on from this stage to the next, there is always, in a proper scheme of agricultural education, a transition period, during which he is still subject to disciplinary measures, while at the same time, he is given more freedom of action, and his work becomes of a more practical nature. It is at this stage that a cadetship at a Botanic Station, or, where this is provided, and where it is intended to take up the more advanced branches of agriculture, a course at an agricultural college becomes of use

The third set of circumstances under which education in agricultural matters is received, is that which obtains while the recipient is actively engaged in the work of a practical agriculturist. This is not a time that has its distinct limit, like that of the conditions just described. It extends just as long as the agricultural work is being done. In other words, those who gain their livelihood from the soil require more than any

others, to be always ready to learn, and to seek opportunities by which their knowledge may be made greater. With the present progress in agriculture, it is very necessary that such individuals shall begin the acquisition of such knowledge under as favourable conditions as possible—that they shall be set in the right way, so that no time may be lost, and that their efforts to gain knowledge shall have the merit and use of orderliness. It is easily seen, in this connection, that the Courses of Reading in Practical Agriculture, of the Imperial Department of Agriculture, have been devised for this very purpose. The steady pursuit of these will make it evident why the education of the practical agriculturist is never regarded as being finished, and why active sympathy with the work of his advisers is necessary to his best welfare.

AGRICULTURAL EDUCATION IN THE SCHOOLS.

BY PRES. KENYON L. BUTTERFIELD,
Amherst, Mass.

Given before the Massachusetts Horticultural Society, March 7th, 1908.

(From the Transactions of the *Massachusetts Horticultural Society*, 1908.)

I like the word "vocational" as applied to a system of training for one's life work. While it suggests that one is preparing for an occupation, it seems to imply that technical skill is not all of vocation, and that the man himself as well as the work he has to do are to be considered in preparation for vocation. This is so because if you show a man what he ought to know about his calling in life you must indicate to him not merely how be may become a skillful worker, but you must tell him how his particular calling is related to other callings, how it is bound up with the welfare of the State and nation, what bearing it has upon the development of civilization, and indeed you must show him also its moral aspects. Consequently while a vocational training prepares men and women for work, it is far from blind to the fact that mere individual skill and efficiency are not sufficient.

It may be objected of course that vocation is not all of life, and consequently that a vocational education is not a liberal training. But I contend that for most people vocation is the larger proportion of life, when you take into consideration all these industrial, political, social and moral relationships. The areas of the two circles are substantially the same. At any rate, this may be said, that for most people vocation is the key to the most of life.

We have several great divisions of vocation, namely,—agriculture, manufacturing, transportation and commerce, home-making and other work for women, and the so-called professions. With respect to the last it may be said that gradually new professions are arising out of the old vocations. It is becoming increasingly evident that education for all these vocations is necessary. In the past we have emphasized the professions and have neglected training for the manual vocations. Furthermore, we have laid stress on the training of leaders; we have not given enough attention to the preparation of subordinates. We have attempted to train men who are supposed to do mental work chiefly; we have neglected to train people who are to intellectualize muscular work. We have attempted to train generals; we have not trained captains. We have made it possible for the few to find their niche in the world's work; we have turned the mass of boys and girls loose to get along as best they could in the struggle for existence.

But now we have come to see that there is a supreme industrial reason for training for vocation. We need to develop the maximum skill of individuals in the interests of production, just as we need to secure the maximum return from a machine or an acre of land. We have learned also that sociologically there is a strong reason for vocational training, lying in the desirability of adjustment of the individual function and ability to social progress. We need to have each man doing the work for which he is best fitted and which the world wants done. We must put the square pegs in the square holes, both in the interest of the individual and of society.

In our industrial problems heretofore agriculture has been treated largely as a non-mental pursuit. It has been looked upon as an art, an art with a low degree of skill,—"any one can farm." But we have reached the time when the abundance of scientific knowledge about agriculture shows that this opinion is no longer tenable. The depletion of soils, under our old system of agriculture which "anybody could follow," further emphasizes our mistake. Furthermore, land was formerly given away and some of it held by the inefficient, now we are approaching a time of land scarcity and a time when land can be held only by the efficient.

Consequently the need of a training for the vocation of agriculture is forced upon our attention, and we find a great movement setting in in which agriculture, as well as our industrial vocations, is knocking at the doors of the schools.

Before going further it would be well to signify that agriculture as we use it implies a rather definite sort of thing. It is not chiefly an art; it is a body of knowledge. While it may not perhaps be justly called a science, such as chemistry, it is an applied science, such as medicine. It has to do not primarily with practices, but with laws. What are the underlying principles that govern soil activity and plant and animal growth, and how may these laws be utilized by man in the production of economic goods? True, agriculture includes the art of farming, although training in agriculture does not attempt to perfect one in the art. On the technical side agriculture would develop reasons for processes.

But it has also a business side. It involves the question of selling,—consequently that of marketing and that of farm management.

It has a social side. Agriculture is related to other industries, and indeed it is fundamental to them. The rural voters are of great political significance, and our forty millions of rural people constitute a great factor in the development of our national life and thought.

Agricultural education, like all other forms of industrial education has, then, its vocational purpose, but it also has its pedagogical purpose. That is to say, it has educational value. It is interesting to know that in the argument made for industrial education to-day men continually hark back to the old days of the farm home regime for children and describe the educational value of the experience in the typical farm home. They say frankly that the chief reason for putting industrial education into the schools, at least so far as mere schooling is concerned, is that if possible something may be developed which shall take the place of this old farm home training. Furthermore, we have come to recognise the value of manual skill in training the mind itself. Even with our definition of agriculture there is room there for manual training. It follows therefore that agriculture may be used for strictly educational purposes, without reference to vocational ends. While in the main agriculture will be taught as a vocational subject, it is worth while to keep in mind that it has also a definite and specific educational value, even for those who are not to follow agriculture as a vocation. Agriculture presents facts that are worth knowing by every intelligent man. It develops principles that illustrate natural laws in many fields. It organizes processes. It gives manual work. All of these things are of definite value to the growing mind. They are educational.

There are three grades of school work in agriculture. First, the college and graduate grade, which may be grouped together for our purposes; second, the high school grade; and third, the elementary grade. The first two define themselves. The third perhaps requires a word of explanation. The schools have been giving nature study for a number of years. Nature study uses many of the materials of agriculture, and while there is perhaps no very sharp line of demarcation between nature work and agriculture in a general way, the two things should be kept apart. Nature work is relatively unorganized and unsystematic. It does not confine itself to any one body of knowledge. It aims to teach the child to observe, to love nature, to appreciate the beauty of the commonplace, and to look for the cause behind the phenomenon. Even elementary agriculture is rather definite and fairly well organized. It studies processes. It has an economic bearing. It deals with an industry. It shows the interests of men making a living from the soil. Its illustrations are specific, such as come, for instance, by the use of school gardens and the incubator.

Now the real question that arises after this brief preliminary survey is this: Shall agriculture as we have defined it be utilized to any large degree in the public school system? So far as college-grade work is concerned this question has been settled. Agricultural colleges have been supported at public expense for fifty years. We need not discuss that question further. The point at issue concerns the work of secondary and elementary agriculture. It seems to me that we may at once answer this question also in the affirmative, provided we are ready to acknowledge the value of agriculture as mental training and are willing to assent to the proposition that the school system shall be utilized for purposes of vocational training.

I do not think it needs elaborate argument to prove that the subject matter of agriculture properly taught gives abundant material for training of the mind. The educational value of science in general and of applied science in particular is pretty commonly recognised. Agriculture offers a most invit-

ing field for the study of science in its application to the work of men. It trains the powers of observation as almost nothing else does. It brings the student into contact with real processes, with men at work, with the man achieving things, with the great current of the world's industrial life. Agriculture in its broad sense has economic and social aspects of large meaning. The importance of the agricultural industry, the dependence of other industries upon it, the development of population, the significance of rural life in our American civilization,—all these things give breadth of view and sanity of judgment. The mental value of the manual art of agriculture, particularly for boys and girls who do not live upon the farm, is generally recognized by the movement for school gardens. I might go on with other illustrations of the educational value of agriculture. I think there is no longer any doubt in the minds of educators about this.

The other question which has been raised is whether the school system shall be utilized for vocational education. We cannot dwell long upon this point, and I do not think we need to. It is true that at the beginning the public school was not designed primarily to prepare for one's life work; it was rather designed to give each child the tools which he could use in any occupation. Gradually, however, there has crept in a new use for the public school system. This movement began when State-supported institutions established courses for law, for medicine, for pharmacy, and the like, and when the normal schools for teachers were established. It was forwarded with particular regard to the industries of life by the passage of the famous Morrill Act of 1862, establishing a college of agriculture and mechanic arts in every State and territory in the Union. The preparation of men for the higher positions in all important vocations of life, including the industries, is now a recognized part of the public system of education. But the movement has gone further than that, and in many States there have been established technical high schools, and commercial departments or courses, with the definite object of preparing boys and girls for the vocations of life, particularly not represented by the professions.

The question now comes up—Shall this movement be extended? Why not? Shall the public school system serve all the people, or shall it continue to serve merely that fraction of our youth who go on into the colleges and become generals or captains of industry? I go so far as to say that our democracy to a great degree depends upon the proper answer to this question. We can never democratize education, we can never democratize industry, we can never thoroughly democratize our civilization until we have made the public school system the feeder for all the great vocations of life. Agriculture plays such an important part in our national labour and life that no scheme of vocational education could for a moment ignore it.

Let us pass to the final questions,—To what extent and how can elementary and secondary agriculture be made a part of the school system?

First, with respect to elementary agriculture. Certainly elementary agriculture should be taught in the rural schools, both because the environment of the child must play so large a part in his education, and because the study of agriculture in the country school will lay a foundation for interest and skill in the agricultural vocation, into which so many of the country-bred children will go. To a degree, elementary agriculture should also go into the city schools because the city environment yields so little to many phases of the child's education, and because the material of agriculture is in itself so fresh, so interesting, so tonic.

There are difficulties in the way of introducing elementary agriculture into the public schools we cannot deny, first, because of the lack of qualified teachers, and second, for lack of time. With respect to the teachers it is safe to say that teachers of elementary agriculture can be trained. They are being trained. But we should not blink the fact that probably the ordinary teacher in the country school who has to teach many things will hardly prepare herself adequately to teach elementary agriculture. If this work is to be done at its best we can expect that only special teachers specifically trained can meet the need.

With regard to the lack of time the only solution is correlation of subject matter. Agriculture may be taught through arithmetic, or, better, arithmetic through agriculture. If agriculture is to be introduced into the lower schools it must not come in simply as an additional subject. It must be related to all other subjects in the curriculum, but related in an organic and definite way.

Now with respect to secondary agriculture. Shall it be put into the high school as a means of education alongside the other subjects, or shall it be only

a means of vocational training by which the school in which it is placed shall be a finishing school? Or shall both be done? I advocate that it be introduced into the schools for both reasons. There are difficulties in making agriculture a part of the regular high school curriculum, and in some schools it will be a long time before that is done. But it is worth doing. I am satisfied that there is a movement now setting in which arises from the interest of the teachers and looks toward this very thing. Some wish to teach agricultural subjects in order that the pupil may be better able to enter the agricultural college.

There can be but one answer to the question,—Shall agriculture of secondary grade be given as a vocational subject? It is needed badly. Our agricultural colleges are doing well, and a few years hence they are going to have many more students than they are having to-day. But as every one knows, they do not meet the need of the great body of young men who will never go to college no matter how good the course, no matter how great the need of training.

Perhaps the most important question which faces us at this time is whether we shall have separate schools of agriculture, or whether we shall put agriculture into existing high schools. Agricultural educators and others are gradually taking sides on this question, and I think it is only fair to say that, whereas as hort time ago the idea seemed to be running in favour of separate schools of agriculture, to-day some of our leading men are making serious objections to the separate schools of agriculture and are advocating very strongly that agriculture shall be put into existing high schools and recognized as a subject of study there. While I do not expect to say the final word on this question, and while in fact I hold myself in readiness to change my opinion, my present answer to this inquiry is that we should do both. I believe keenly, to put the matter in a nutshell, that we ought to place agriculture in the high schools alongside of other subjects of study, but I believe that at the same time we should establish separate schools of agriculture substantially of secondary grade.

Let me state some of the advantages of the separate schools. In the first place they emphasize vocation. It seems to me that the ordinary course of study in the high school, in the nature of things cannot, and perhaps should not, give due emphasis to a particular calling. The special task of the high school is to give foundation training. Inevitably the demand for vocational education will compel high schools to offer also courses fitting pupils for various occupations. But almost as inevitably the occupational courses will be segregated. Whether or not the separation shall be so marked that an entirely new school shall be set apart for a given vocation or set of vocations is a question to be determined entirely by circumstances. Some towns can afford the separate schools, some cannot.

In the second place, the separate school is likely to have more adequate equipment for specialized purposes. It is difficult for the average high school to procure adequate land, animals, crops, teachers. The separate high school of agriculture *must have* those things, merely to justify its existence as an agricultural school. It takes a large equipment for the proper study of agriculture if the course is to fit one for the business. Few high schools can afford the expense.

In the third place, separate schools will have the agricultural atmosphere. Students will think, act and dream in terms of agriculture. Whichever way they turn they come upon something that drives home the fact that they are studying agriculture, that they are preparing for their vocation.

And finally, separate schools of agriculture will naturally evolve into finishing schools for young men who cannot go to college. I do not believe our public high schools will ever devote sufficient attention to any one vocation like agriculture to make it possible for them to train the number of men who ought to be trained for work upon the farm. It seems to me imperative that we recognize this need, and that we supply it by that form of school which definitely makes agriculture, as a life work, its principal objects and aim.

There are many objections raised to separate schools of agriculture. One of them is that the high schools can do this work well enough. In the first place, however, you must remember that this equipment costs money. Our larger high schools are in the city, and even if they put agriculture into the high schools they are bound to reach only a small proportion of the pupils who need this work. You will have the anomaly also of an agricultural school or courses of study in a city environment. Of course it would be possible for the city to establish its high school out in the suburbs in the rural section, but when you have done that you have to all intents and purposes made a separate high school.

It is also objected that if you have separate schools you break down the present school system. It seems to me that in answer to this we would say that separate *work* is a necessity for adequate vocational training. We must organize agriculture as a vocational subject of study by itself, related of course to other subjects, but still a thing somewhat by itself, if you are to get real vocational results. And this process logically will probably eventuate in separate schools for agriculture. Furthermore, I do not see that it is necessary to separate these individual agricultural high schools from the public school *system*. It seems to me that we must maintain the integrity of our public school system, but I do not believe that the mere fact of establishing an agricultural high school leads necessarily to making that school something apart from the public school system.

It is also urged that separate schools make a cleavage of social classes. On this point my feeling is this. It is better to have cleavage within the schools than to have a cleavage between the schooled who do not go into industries and the unschooled who do. And that is precisely what has taken place in the days gone by. Those who went through the high schools have largely gone into professions. They have not gone into industry. And boys who have gone into industry have not been educated in the high schools.

If you put agriculture into the high schools, you attract those who want to go into this field of industry. Sooner or later there may come some cleavage in the school itself. If agricultural education is introduced into the school, and the school is made really vocational, made really a finishing course, it will of course be marked off necessarily from other educational training and from work of a general type. But I foresee no serious danger from this. Vocations do inevitably breed social classes. I can't see that thorough training for vocations, even in schools specially devoted to that purpose, is likely to increase the tendency to stratification. It will rather break it down because each occupation will be dignified by being intellectualized.

And finally, I object to the idea implied in the argument against separate schools of agriculture, that a vocational course fails to educate a man as well as to make a worker. I claim that a well-balanced course of agriculture, properly taught, trains men, and that it has definite educational values. Hence such a course is still an educator of men as well as a trainer of workers. The man is trained as a worker and the worker is educated as a man. In the same way in which a man educated *by* his work, so a man may be educated in the process of being trained *for* his work.

Let us then put agriculture into the schools everywhere. Let us have separate schools of agriculture wherever such schools can be maintained. Let us also put agriculture into the regular work of existing schools. Let us give every boy and girl in the Commonwealth a chance to prepare for farm life, and at least to use the splendid materials offered by agriculture in securing a broader outlook upon life.

Discussion.

Dr. David F. Lincoln asked for further information concerning the proposed Northampton school.

Pres. Butterfield replied that he was not familiar with all the plans, but it was expected to open the school next autumn. It is established as the result of a provision made by Mr. Smith of Northampton some sixty years ago. After much delay the city has decided to aid in organizing it, and a Director has been chosen.

It will be a school for youth who desire to get practical work in horticulture and husbandary on the farm, and at the same time have some regular school studies with it. The aim of the course will be to give general as well as technical instruction. He stated that a farm had been purchased on the outskirts of Northampton, and that it would be a boarding school. He said that this kind of a school would develop in a little different way than an agricultural high school, or any organization in a small town. It will become a sort of semi-agricultural college, though open to boys as young, perhaps, as fourteen years. They will take up subjects not taken in college. The length of the course is to be four years, and a course of study has been outlined in a pamphlet issued by the Commission on Industrial Education. Pres. Butterfield said he thought there was need of such an institution in the State.

Pres. Butterfield referred also to the Davis Bill, introduced into Congress by Congressman Davis of Minnesota, which provides $8,000,000 to be distributed to States on the per capita basis. The Bill calls for establishment of schools of agriculture and mechanic arts in each State and under its provisions agricultural schools can be provided in agricultural sections.

The income is limited to ten cents per capita, thus Massachusetts would receive about $325,000 for this purpose. He thought that the Bill would not be likely to pass this season, but it was being pushed by interested parties, and would, no doubt, soon become a law.

Robert Cameron inquired how far this agricultural school would carry a boy. Would he be able to analyze soil and water? He further asked what the boys would be able to do after being graduated from the agricultural school rather than the high school.

Pres. Butterfield replied that people very often mistake the work of a farmer. Analyze soil and water is the province of the man in the laboratory and not the farmer. In training farmers we do not make chemists of them; we do try to make them understand the fundamental principles of farming. He said that in some cases in the college work men do not get the best results. Some were not fitted or were incapable of making a success of the vocation. The ideal of the college standing back of its graduates had not been reached. A boy who is quite capable of doing the required work in good shape in the college might, when placed in a position where he must do the real work and make it a success, be a failure. He said that he thought the course in an agricultural college could be further developed by requiring that every boy should have had at least one summer of practical work in managing a firm.

AGRICULTURAL TEACHING FOR THE RYOT.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 8, August 2, 1909.)

It has often been said that the chief problem of Agricultural Departments in this country is how to get the results of experiment and research to the knowledge of the ryot. To establish certain conclusions at Pusa is one thing; to place these achievements at the disposal of the actual cultivators of the soil is another and much more difficult matter. The question has for some years been engaging the attention of the officers concerned, and in the recently issued Report of the Board of Agriculture a brief account is given of the discussion on the subject held in Nagpur last February. The symposium, as it may perhaps be called, centered on the report of a Committee which had considered the best means of reaching the ryot. Dr. Mann, by whom the recommendations of the Committee were brought up, has long been an enthusiastic advocate of popularising experimental results, and no exception can be taken to his statement of the general principles on which attempts to educate the masses must be based if they are to be successful. Whoever wishes to teach the ryot must have a personality which will win confidence. He must have an accurate knowledge of local conditions. The peasantry everywhere in the world are inclined to doubt whether a stranger's theories will apply to their part of the country, and if this initial distrust is to be overcome, it can only be by showing an exact familiarity with what the peasant himself knows. The methods which it is sought to introduce should be such as will pay a profit when the increased cost has been taken into account. Dr. Mann also insisted upon the necessity of enabling the ryot to get capital at a cheaper rate by means of agricultural banks and similar organisations. The financial aspects of the improvement of agriculture must undoubtedly be kept in mind from first to last. It would be dubious kindness to induce the ryot to adopt a new method which, though profitable under ideal conditions, was more costly to him than his own familiar way. It is, moreover, idle to obtain great results on experimental farms by the use of manures or appliances which are beyond the means of the ryot. As bearing on this point we note with interest that the Director of Agriculture in Eastern Bengal and Assam, in sketching the work to be undertaken on the agricultural stations, says:—"The scheme of sugarcane experiments has been remodelled with a view to (*a*) the existing soil conditions of the farms, (*b*) the limited resources of local ryots. It is considered that heavy doses of oil cake and other expensive manures are not within the means of ordinary ryots and prejudice whatever good results may be obtained on the farms. At Rajshahi and Jorhat it is therefore proposed to experiment with a view to find the best cane for local conditions with the manurial treatment most generally in vogue in the neighbourhood." This new scheme is obviously on the right lines, though it is plain that the improvement of manures, with a due regard to the means of the ryot is a most important branch of agricultural reforms. Dr. Mann's final recommendation was that efforts at agricultural improvement should be concentrated on small areas and on problems of a definite character. This suggestion is fully in accord with the policy which its author pursued when he served as Scientific Officer of the Indian Tea Association and which

led to a general recognition among tea planters of the value of scientific assistance in coping with the problems of tea-culture. Among the speakers who followed Dr. Mann, the Chief Commissioner of the Central Provinces was perhaps the most practical, touching as he did on the close connection between agricultural reforms and co-operative credit. Many will be disposed to think that the solution of many difficulties will be found by linking co-operative societies with any scheme for disseminating agricultural information. It seems reasonable to suppose that, if a Co-operative Society is working on right lines and is enabling its members to win their way out of a condition of debt and dependence, it will kindle in the minds of these members a desire for better methods of cultivation and for making a more profitable use of their land. And being already organised for one useful end they should find it an easy matter to co-operate for other purposes such as the purchase of any artificial manure which may be recommended by the Agricultural Department or of appliances, similarly recommended, which they could not individually afford to obtain. There is indeed no limit to the beneficent operations of Co-operative Societies when they once have taken root and have attained an independent vitality. The Royal Commission on Decentralisation rejected the proposal that the revival of the village punchayat should be entrusted to the Registrars of Co-operative Credit Societies, but we are not convinced that the idea is not deserving of further consideration, for a vigorous Co-operative Society might well become the village organisation for all the purposes which require the united action of the villagers.

THE SCHOOL OF AGRICULTURE.

(From the *Uuiversity Farm*, Davis, California, No. 43, September, 1909.)

The School of Agriculture opened for instruction to regular students in January, 1909. Its purpose is to furnish a technical training in agriculture to those who do not wish, or do not feel able, to pursue a college course. The regular course is for three years, and does not fulfil the requirements for entrance to college. After finishing the course in the school, however, a student can usually make up the remaining college entrance subjects, if he wishes to do so, by spending a year or two at an accredited high school.

The plan of the school is ultimately to include work in Domestic Science for girls. But at present, owing to insufficient facilities, only boys are admitted to the School.

LENGTH OF SCHOOL YEAR.—The school year is divided into two terms. The first term begins during the latter part of September and runs until Christmas; the second terms begins immediately after New Year and closes early in May. Instruction begins promptly at the beginning of the term, and all students are expected to be present on the first day of the term, and to remain until the close of the term.

COURSE OF STUDY.—The course of study covers quite completely the various branches of agriculture followed in this State. The principal aim of the course, however, is to give sufficient understanding of the fundamental principles upon which all successful agriculture is based, so that those who have completed the course will be able to act intelligently in arriving at a solution of the individual problems which every farming enterprise presents. With this end in view, more than half of the work of the course is actual laboratory or field work. Most of the time is spent on strictly agricultural subjects, but solid courses are given in practical English, mathematics and history.

COURSES OF STUDY.

	First term, 13 weeks.	Second term, 18 weeks.
First Year.		
Botany and Plant Propagation ...	8	8
Livestock Judging ...	—	4
Agriculture ...	5	4
Entomology ...	6	—
Poultry ...	—	5
Farm Practice ...	3	3
Arithmetic and Algebra	3	3
English	3	3
Second Year.		
Chemistry	8	8
Horticulture and Viticulture	6	6
Animal Industry ...	10	—
Dairy Industry ...	—	8
Farm Accounts ...	—	2
Mathematics ...	3	3
English	3	3
Third Year.		
Soil Fertility and Farm Crops	6	6
Farm Mechanics ...	6	6
Irrigation	4	4
Animal Physiology and Animal Industry ...	4	4
Elective	4	4
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Note.—During 1909-10 second-year students will take, in place of animal industry first term, Entomology (6) and Poultry (5) or Agriculture (5). Animal industry will be given in the second term in place of dairy industry.

MISCELLANEOUS.

FARMERS' CO-OPERATIVE SOCIETIES.

(*Extract from Board of Agriculture, (England) Leaflet, No. 97.*)

The idea of combining for purposes of trade in Societies conducted on co-operative lines perhaps originated in England, where it has certainly received its greatest development. While, however, English workmen have always been the foremost in this movement, English farmers have too often stood aloof and have allowed foreign nations to carry agricultural co-operation to a point unknown in this country. There are many reasons for this reluctance to join Co-operative Societies, reasons which are not at all discreditable to the farming class, who have often shown themselves fully capable of combining in other directions. Yet it has proved disastrous to them in some respects, for it has enabled the farmers of foreign nations, who have shown greater aptitude in trade combination, to secure markets for their produce in competition with English growers.

There are signs, however, that this unwillingness is dying out, and there are many Societies throughout the United Kingdom which are carrying on a successful business which farmers and all other cultivators of the soil would do well in joining, though there is still ample room for the formation of other Societies on similar lines.

Agricultural Co-operation may be applied in four ways:—(1) The joint purchase of farm requisities, such as artificial manures, feeding stuffs, seeds and implements; (2) The joint sale of agricultural produce; (3) Mutual insurance; and (4) Credit banks and loan societies on co-operative lines. The present leaflet deals only with the first two subjects, the last two being considered in separate leaflets.

SOCIETIES FOR THE PURCHASE OF FARM REQUISITES.

This kind of society is obviously the most simple and most readily adapted to farming needs. Indeed, there are some large associations of this order which have a continuous history extending over thirty or forty years, and which have undoubtedly been of great service to the agricultural classes. The benefit of such societies is perhaps most obvious to small farmers, who only require to buy manures, cake, seeds and implements in small quantities. By purchasing direct from the manufacturer and selling at a trifle above cost price a Co-operative Society enables a small farmer to procure his goods at a much more moderate price than would be possible if he purchased on his own account from local dealers. He obtains the benefit of lower rates of carriage, and is assured by guarantee of the genuineness of his goods.

The benefit to a large farmer is equally great, though for a less obvious reason. The quality of manures and feeding stuffs can practically only be tested by analysis, and even then some scientific knowledge is requisite to appreciate the results obtained and the relation between the price charged and the value represented by the analysis. By joining a Co-operative Society a farmer is assured not only that he is paying the proper market price, but also that he is getting a genuine article for his money, for it cannot be to a Society's interest to cheat its own members.

SOCIETIES FOR THE SALE OF AGRICULTURAL PRODUCE.

Societies for the sale of produce are chiefly of benefit to small farmers and persons who confine their attention to a few kinds of agricultural produce. They are certainly also useful to those extensively occupied in mixed farming, though it is chiefly among dairy farmers that societies for the sale of produce find their members. It is well known that in Denmark, where large quantities of milk are made into butter for the foreign market, the dairy farmers have formed Co-operative Societies in order to secure not only economy in manufacture, but also that uniformity of quality which has enabled them to displace their rivals. Small holders who desire to sell their produce in the market will find membership of a well-managed Co-operative Society an enormous advantage, inasmuch as they will be saved the trouble and expense of marketing their goods, and will be able to devote the time so saved to the cultivation of their holding. A double saving is thus

secured. It must not be supposed, however, that the Society for purchase cannot also be a Society for sale. It is useful to begin with the former class of business and proceed to the latter as the Society progresses and prospers.

The secret of success of all co-operative trading, however, is solidarity of union. Every member of a Society who undertakes to sell his produce at the Society's store or depôt should be bound to offer all his produce if wanted, or at any rate the best he has. If he tries to sell his best produce privately and only sends his inferior stuff to the Store he is acting against the interest of the Society and may bring about its downfall, since no customer will go to a store where only second-rate goods are to be bought when better produce is on sale elsewhere. This point cannot be too strongly insisted upon, and should form one of the rules of every Society that is formed.

The second point is that profits should be divided in proportion to trade done, and not to capital invested. There are many Societies formed on joint stock lines with which farmers may usefully and profitably trade, but these are not Co-operative Societies in the true sense of the word, and small local Societies should not be formed on these lines. If profits are divided according to trade done every member has an additional inducement to support the Society by his custom.

Finally, it is advisable that societies should not attempt too extensive a business at the beginning. Leaflet No. 111 (*Co-operative Egg and Poultry Societies*) shows how small societies may be formed for the purpose of dealing in one class of produce. It is usually advisable to begin in this way, and to extend the business as trade grows. It tends to greater security, and is less likely to rouse the hostility of other local traders.

AGRICULTURAL DEVELOPMENT.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 9, September 1, 1909.)

It is but too frequently repeated a truism that more than eighty per cent. of the people of India live on agriculture, that it is the staple industry of the country. For years and years now it has also become an equally patent fact that this resource is slowly but surely failing us, and that the land has ceased to yield enough to maintain the millions that live on its bosom. All this is perfectly true, and the ancient idea of agriculture being the best of all pursuits has begun to look ridiculous in the light of existing conditions. Many causes have brought about this sad state of things. What with the heavy Government assessment, the frequent failures of the monsoon currents, plague and such other evils, the Indian cultivator has come to be on his last legs; and unless something is done for him, and the agriculturist himself is induced to do something for his own salvation, his case seems to be as hopeless as that of the nomadic tribes that haunt the terrible sandy wastes of the Sahara. When reflecting upon the present sad condition of the Indian cultivator one important point, however, is generally completely lost sight of—the comparative question of population. It will be hypocritical to deny that the Land-tax is heavy; that the way in which it is collected inconveniently exacting; that the erratic course of the monsoons not only ruins the crops but also, by withholding a plentiful supply of fodder, kills millions of cattle—the most valuable asset of every Indian agriculturist. But why lay all the sins of commission and omission only at the door of the causes of deterioration we have mentioned above, and lose sight of the tremendous increase that has taken place in the population during the last hundred years, the irresponsible multiplication which has taken place as a result of the *Pax Britannica*? A certain area can, even under the best climatic conditions, support only a certain number of people. If the number of voracious mouths increases by leaps and bounds and no effort is made to add, by scientific means, to the productive capacity of the land—can the latter be held responsible for all the sufferings of those who live thereon? This is an aspect of the question that has not been given as serious attention as it deserved. The "Extremists" on this particular question twit the Government with the excessive Land-tax and their spending more on railway construction than on irrigation, and attribute this as the great cause of our frequent famines and chronic scarcity. The authorities, on the other hand, very pertinently ask the question, were there no famines in India before the British Government stepped in? Both the parties are in one sense right, but each has lost sight of one fundamental fact. The interrogator forgets that whereas his *vatan*, a hundred years ago, supported a dozen people, it has now to support twice if not four times that number. And all the while the land has been deteriorating. Exhaustion is a universal and eternal law. Government, on the other hand, forget that, though there

were famines in the pre-British days, the helpless months to be fed were not as bewilderingly numerous as they are now—and that there were *no* exports of food grains in those days—neither Railways nor Ralli Brothers. So, to no small extent, both the combatants may be said to have been arguing in a circle—losing complete sight of the essential necessities of the situation. The people must accept the inevitable—the existence of British supremacy, and cultivate the art of adapting themselves to existent circumstances. Since irrigation on any colossal scale is *non est*, and so the *expansion* of the *area* cultivated impossible, their only salvation lies in eking out the maximum of product from the land already under cultivation, by nourishing it with artificial means and scientific methods and make it yield far more than it has hitherto or ever before done. On the other hand, the British authorities should also remember that since Railway extension, heavy land assessment, Income and Salt taxes, a perfect but ruinously costly system of administration, a heavy military outlay, etc., are unavoidable in the circumstances of the case, their best genius, *bona fides* and energy should be directed towards helping the productive capacity of the agriculturist, who represents more than eighty per cent. of the population, in order that he may be able simultaneously to support his aggravatingly multiplied brood, as also to meet the demands made upon him by the exigencies of a foreign domination. It will thus be seen that the unprofitable process of arguing in a circle has gone on too long. The people must do a good deal in the matter and the Government a great deal more. What Government ought to do in the matter has been stated so unequivocally and so repeatedly by responsible Indian thinkers and politicians, that we will not to-day look into this side of the question. We have no doubt, that with the promising era of reform that will shortly open, Government will do the needful in the matter of lessening the burden of the Land-tax, taking up in hand, more seriously than hitherto, the question of irrigation, and providing every possible facility to the ignorant Indian agriculturist for improving his own lot. But, on the other hand, the Indian cultivator must be made to realise that his beloved "mother earth" loves him as much as she did his forefathers, but that she is completely exhausted, through more than the proverbial thousand and one causes, and that she cannot now provide for him and his brood of unearning and unheeding progeny, unless she is better taken care of. Herein lies the crux of the question. There has been so much talk lately about ideals—Swadeshi and others—that absolutely nothing has been *done* towards, what we may call, a practical awakening—particularly in the matter of an agricultural revival. Efforts in this direction have spasmodically been made, in a *dilettante* sort of manner. But unless the country, as a whole, realises the necessity of introducing such reforms as can alone make the land yield enough to meet the needs of the ever-increasing population, it is bootless to hope that the prospects of the "staple" industry of the land can in any way improve.

But, to come to the point. Since "passive resistance," and such other shiboleths have reached a high level of suicidal aggressiveness, and have proved miserable failures, does it not behove all honest patriots to try their best to inspire, encourage and revive the agricultural industry? So far as the Bombay Presidency is concerned, the Hon. Sir Muir Mackenzie has been trying all along his best. He may be said to have been the father of agricultural conferences in this presidency. That his interest in this important question has not a bit abated can best be gathered from the fact, that he presided this week at the inauguration of the Deccan Agricultural Association in Poona. The remarkable speech which the Senior Member of the Bombay Council made on the occasion should be most carefully studied by everybody interested in the improvement of agriculture. The Agricultural Association just started in the capital of the Deccan is a move in the right direction. We have pointed out above how, through various causes, the productiveness of the land has deteriorated. The only remedy for improving the position lies in bringing home to the ryot the importance and paramount necessity of adopting latest scientific methods. There must, in fact, be a regular and continuous campaign of agricultural education. In this respect it must be admitted that the Bombay Government have done a good deal. Thanks to the living interest taken in the subject by the Hon. Sir Muir Mackenzie, an Agricultural College has been established and a number of scholarships offered. The various Government farms also practically illustrate what can be done in the matter of improved agriculture. But these institutions cannot possibly reach the general mass of cultivators. This work must be undertaken by local bodies like the Association just started at Poona—there must be at least one for each

district. The present is a promising time for the starting of such bodies. There was a time when the Indian agriculturist was conservative to a degree, and believed that the methods which had been handed down from sire to son through ages were the best. But by slow degrees this feeling is changing. Even ignorant villagers have slowly but surely begun to realise that science really has something practical to teach, that the information already acquired is worth disseminating, and that given a problem there is not unseldom a solution ready, or if not ready, that it will be found. It is just at such psychological moment that earnest efforts must be made to convert the ryot. Hitherto there has been no spontaneous effort on his part. Lack of means, smallness of holdings, the frequency of famines and their innate conservatism have all combined to prevent any general movement for agricultural improvement. But, we are sure, even the most ignorant ryots are now in a mood to be won if they are only properly wooed. What is necessary is practical and frequent demonstration of the unmistakable superiority of modern scientific methods over the ancient but crude ones mostly followed. This can best be done by district associations and by the more substantial and enlightened of landowners. The problem of improved agriculture opens a vast field for the superfluous energy of those who are devoting it at present solely to unproductive politics.—*The Parsi.*

AGRICULTURAL ASSOCIATIONS.

(From the *Journal of the Board of Agriculture, India*, 17th February, 1908.)

The formation of local Associations for agricultural improvements has been one of the most common methods of increasing interest in the subject. It has been successful in some cases and more especially in the Central Provinces. On the other hand the success has by no means been universal.

In the Central Provinces, the local Agricultural Association is most directly connected with the Agricultural Department of the Province. The district is taken as a unit and the Collector is Chairman of the Association. The influence and co-operation of the district officers is considered to be an essential condition of success. It is held that the Associations must be in close touch with the superior officers of the Agricultural Department, one of whom always attends the meetings of the Associations. The meetings are held half-yearly before the opening of the *kharif* and the *rabi* seasons, and the Director and Deputy Directors devote some months each year at these times to going from meeting to meeting. Thus they know the members personally. The members are limited in number, and consist chiefly or almost entirely of substantial agriculturists, owners of villages who are also cultivators, heads of sub-divisions of cultivating castes and the like,—and the members undertake to carry out a demonstration of an improvement suggested by the Department. In this they are assisted with seed, implements, or other materials needed for the purpose, and their work is inspected by the Superintendent of the nearest farm or other member of the Departmental staff. At every meeting an actual programme of work is submitted, criticised by the members, modified, if necessary, and the several pieces of demonstration allotted to the members. At the meeting the method of lecturing without any actual programme of work is being given up. In the programme no piece of work is recommended by the Agricultural Department, unless it has been proved by the Department itself to be likely to succeed. Two meetings such as have been described are held annually, and though the people clamour for more, it is considered advisable not to add to the number. The time of holding these meetings depends on the system of cropping.

These Associations have been largely instrumental in introducing superior varieties of *tur*, of *jowar* and of sugar cane, and the adoption of improved implements. The greatest advantage is, however, felt to be that they bring the Department into close touch with the best cultivators in each district.

In Madras, the development of Agricultural Associations has taken a more independent line. They are officially patronised but are independent bodies. They usually take the district as the unit, but branch associations are formed in smaller areas. Their utility generally depends on the activity of local men, generally educated men and often substantial land-holders. They have in the deltaic areas been the means of introducing the system of transplanting single seedlings in rice cultivation. Elsewhere they have brought into practice improvements in manure conservation; they have caused the use of the process of green manuring with wild indigo after paddy to be adopted in the Tanjore district, and have introduced iron ploughs. They have been instrumental in extending the culti-

vation of paddy in Tinnevelly, jute in Tanjore and Malabar, and ground-nut in Malabar and South Canara. They have, however, not been in existence long enough for a definite opinion to be formed of their general utility. There is a Central Agricultural Committee in Madras which forms a link between the various local Associations.

In Bombay there has been comparatively little development on this line, but three District and a number of Taluka Associations exist. They are always independent bodies and often combine in their functions other purposes as well as those of agricultural improvement. The two most active and successful are in Dharwar (a District Association) and in the Sangamner Taluka of the Ahmednagar District. In each case they depend largely for their success on the personal influence of an active local man, and they only have official patronage. In Dharwar the Association has been instrumental in bringing about the extension of the cultivation of Broach cotton in the district, the more careful selection of Dharwar-American cotton seed, and the adoption of the Turnwrest plough. In Samgamner the Association organises an exceedingly important local agricultural show subsidised by the Agricultural Department, and has introduced improved varieties of wheat. It has lead to the establishment of a grain bank; while breeding bulls have been introduced as a result of its operations. Many of the Bombay Associations are continually asking for demonstration to undertake; and the difficulty has been and is now to find matters of proved value for them to try.

In Bengal a Provincial Agricultural Association and Divisional and District Associations have recently been formed, but it is too early to say what their effect has been. These Associations are largely composed of townsmen, pleaders and Zamindars not themselves cultivators. In fact cultivators' holdings are generally so small that it is considered unlikely that agricultural Associations on the model of those in the Central Provinces are likely to succeed.

The utility of Agricultural Associations seems to depend largely on the presence of a body of substantial men who are also cultivators, on the *personal* touch of the higher staff of the Agricultural Department with the members, on the definite engagement by the members to do definite pieces of work, and on the regularity of meetings, inspections and reports. In other matters conditions will vary with the districts. It may and will be advisable to have smaller associations than those of a district in some instances. If such smaller associations can be sufficiently substantial and intelligent, the Sub-Committee considers that they should be encouraged.

NOTE ON ARGEMONE MEXICANA.

BY J. H. MAIDEN.

(From the *Agricultural Gazette of N.S.W.*, Vol. XIX., Part 10, October, 1908.)

(Previous references,—1891, Jan., p. 32; March, p. 125; April, p. 175; 1895, March, p. 157; April, p. 227; 1897, Jan., p. 3; 1899, June, p. 490; 1901, June, p. 643.)

This weed known as "Blue Thistle," "Yellow Puppy," "Mexican Poppy," "Devil's Fig," "White Thistle," "Binniguy Thistle," "Prickly Poppy," is widely looked upon in New South Wales as one of the few weeds without any redeeming feature.

In the *Cape of Good Hope Agricultural Journal* (April, 1908, p. 493) the following statement appeared :—

Mr. Bergh (Modder River) moved :— "That Congress (Farmers' Congress, 1908) recommends to Government the necessity for removing from the list of noxious weeds the plant commonly called Mexican Poppy." Seconded by Mr. Haarhoff.

Mr. P. Nel (Beaufort West) moved, as an amendment :—"That the Government be informed of the diversity of opinion between farmers as to the value or otherwise of the Mexican poppy as a fodder plant, and that they be requested to appoint experts to make immediate investigation."

On a vote being taken, the amendment was negatived, and the motion agreed to."

On inquiry of the Under-Secretary for Agriculture at Capetown, the following information was elicited :—

With reference to your letter of the 15th May last, relative to the above subject, I am directed to inform you that the principal reason advanced by those wishing to have Mexican Poppy (*Argemone mexicama*) withdrawn from the list of noxious plants is that in their opinion it is not only uninjurious to, but will even, in certain seasons, serve as food for stock. This statement it will be noted is not an official one by the Department, but emanates from the farmers themselves.

Now I want to give even Blue Thistle its due, and if any one will show cause why this weed should not be exterminated, I shall be very glad to hear it. I particularly desire evidence that stock eat it, not an odd nibble, but use it as food.

[This is the yellow flowered thistle-like poppy, not infrequent as a weed in the dry country, *e.g.*, about Elephant Pass.—ED.]

CO-OPERATIVE CREDIT SOCIETIES:

PROCEEDINGS OF THE FOURTH CONFERENCE OF REGISTRARS.

(From the *Indian Agriculturist,* Vol. XXXV., No. 2, February 1, 1910.)

One of the most interesting chapters of the Proceedings of the Fourth Conference of Registrars of Co-operative Credit Societies is the report of the discussion on the question how best to encourage the assistance of non-officials. In some parts of India this problem has not to be faced. Mr. Ramachandra Rao, of Madras, stated that he had more offers of non-official aid than he could make use of. But in Bengal and in some other Provinces public spirit among leading men has apparently not risen to the level which it has attained in Madras, and it has become necessary to consider seriously how the help which is ungrudgingly given in European countries and in Madras can be secured. The discussion was opened by Mr. Buchan, who in a brief paper described the present condition of affairs. The Registrar in most Provinces is no longer able to undertake the very important work of propaganda. It is as much as he can do to supervise the societies already in existence. Owing to the lack of local organisers he has been put in the position of a financing agency, an arrangement which Mr. Buchan rightly declares to be unsound. If the Co-operative Societies are to have any life in them, and to embody a healthy spirit of self-help, they must be able to attract local capital instead of relying upon such loans as the Registrar is able to arrange with the aid of a few philanthropists, and obviously if a loan to a Co-operative Society is a safe investment yielding a reasonable return on the security, money ought to be forthcoming locally from those who know the society and its work. Further, agricultural co-operation admits of many varieties of form, which are indeed necessary if full advantage is to be taken of its principles. One locality needs one kind of co-operation, a second locality requires another. Different forms are indeed in vogue in almost every Province in India. So much depends, however, on the locality and its special needs that for the successful adaptation of co-operative credit to local peculiarities the assistance of local men is essential. All these facts points to the necessity of enlisting the aid of a sufficient number of voluntary organisers. But the main ground upon which such help must be obtained is that tersely stated by Mr. Buchan:—"In no country has co-operation become a force until it has become a popular movement. And so it will be in India." Believing, as we do, that in the adoption, on a national scale, of the principles of co-operative credit will be found the remedy for the want of capital and the heavy indebtedness from which Indian Agriculture is suffering, and recognising that only by means of the assistance of the educated classes can the movement become popular in India, we are convinced that no effort should be spared to make the work of superintending societies attractive to men who have the requisite education and leisure. Mr. Buchan's suggestion is that District Co-operative Committees should be formed, composed of members really interested in co-operative credit, whose object it should be to spread co-operative principles, work out schemes for the formation of new societies, and supervise these societies when formed. It is not improbable that this idea would prove effective. This disinclination to personal service may be in some measure due to ignorance of what responsibility is involed and of what should be done. A committee would remove these difficulties and be a means of training new members in the practical application of co-operative principles. Mr. Buchan proposes that the District Officer should be honorary president of the District Committee. This feature of his scheme is scarcely necessary, and lays it open to the criticism offered by Mr. Fremantle that "societies started by prominent men in order to please the Collector would not do any useful work." There is no reason why the District Officer should not give all the aid that he can, but it should be distinctly understood that only willing helpers are wanted, and that those who are not interested are disqualified. Two Indian Registrars are of opinion that the Government ought to recognise the work of the honorary organisers in some appropriate manner. They may be presumed to know the failings of their own men of light and

leading, but the large number of literary and other societies which exist in this country would seem to indicate that there is an abundant supply of disinterested service if only it can be tapped. If, however, rewards are required we know of few forms of public work which are more deserving of encouragement than efforts to lift the peasantry of India out of the morass of debt.

IRRIGATION METHODS.

By A. S. Kenyon.

(From the *Philippine Agricultural Review*, Vol. I., No. 10, October, 1908.)

A correspondent writes asking for some notes on the amount of water necessary for the growth of different crops, the best means of applying the water, the number of applications, and the periods of the year for watering. This makes too much of a demand upon the limited space available for "Answers to Correspondents," so that the reply is given here in the ordinary pages of the Journal as being of general interest.

In the first place, the volumes of water required for the full growth of various crops will vary very much. Water is directly required by plants for transpiration or evaporation through the surfaces of their leaves, consequently the amount of foliage is an important factor, and for the formation of their actual bulk, of which water is a large constituent, running, in some cases, over 90 per cent.; but its greatest service is in dissolving and thus rendering available the plant foods contained in the soil. In many parts of the State winter crops get sufficient moisture from the heavens for all their requirements, at any rate with proper cultivation, while the same may be said to a less degree of summer crops. The latter may be successfully grown, without artificial aid in watering, over large areas where they are at present either whole or partial failures, by the adoption of improved methods which are, in general, sowing in drills sufficiently wide apart to permit of cultivation and, especially after rains, the frequent use of the horse-hoe or scuffler, between them. But in other localities—over the greatest part of our northern districts—winter crops require additional moisture in many, nay, most years, and the summer crops always. The supply of these requirements is met by irrigation which may be derived from public works under the State rivers and water supply commision or from private sources, such as pumping plants or by the construction of dams. It is well to bear in mind that the Water Act 1905, the water in all rivers, creeks, lakes, lagoons or marshes even if wholly on private land, is the property of the Crown and can only be used lawfully for irrigation under the authority of the Commission. True, riparian owners are entitled to the free irrigation of 3 acres; but only in direct connection with a homestead or for its service, so that the exception is only trifling. Licenses to divert water from any source may be obtained on reasonable terms and give a much-desired security of tenure.

Having obtained the water, care must be taken in applying it to the ground so as to make a thorough job of it. Mere soaking of the top few inches only means early loss by evaporation with but little water reaching the subsoil to be there stored for future use. Surface roots are encouraged and a brief stimulus given the plant, too soon to be lost. As water cannot be forced into the ground, sufficient time must be allowed for it to soak in and penetrate to a reasonable depth. The time necessary may be as little as fourteen hours, but will generally amount to twenty-four or over. The volume of water necessary will depend upon the character of the soil, and upon the method of distributing adopted the rooting character of the plant will also be a factor, tomatoes and lucerne, for instance, requiring very different volumes. The volume may vary from 3 inches or under to as much as 20 inches in depth over the whole surface. The most usual depth is found to be about 7 inches. One inch in depth over a surface of one acre is equivalent to 23,000 gallons or 3,630 cubic feet.

The best means of distributing the water so as to reach the plant's roots, is undoubtedly underground perforated pipes; but this is a very costly method and one not likely to be brought into use here for some time to come. The next best is by distributing furrows. The furrows are ploughed out by the ordinary garden or orchard plough and generally along the line of fall, the plants being sown in drills to suit. The distance apart of the furrows depends upon the nature of the soil; but 6 to 8 feet may be taken as the furthest and 3 feet as the most general. For fruit trees, only two furrows are used for the first two years, one on each side of the row. Later, as the root system increases, four or five furrows in each, depending upon the distance apart of the trees, are adopted. The water is let into the furrows from a head ditch or distribu-

tary channel by outlets made of iron pipes, wooden boxes, or simply shovel cuts secured from washing out by wisps of straw or grass. Largely the amount let out to each furrow must be determined by experience and "rule-of-thumb" methods. The length of the furrows varies with the nature of the soil, the slope, and the natural features; they should rarely exceed ten chains in length and are more generally about five. Sufficient flow should be allowed into each to just reach the lower end after thoroughly soaking the ground on the way. As soon after watering as the state of the soil will permit, the scuffler or harrows should be run over the surface to form an earth mulch to retain the moisture. Cultivation as soon as possible after watering is not only essential for the furrow method, but for all the systems.

The corrugation or permanent furrow is the next way of distributing the irrigation water. For lucerne, the greatest of the fodder crops, this system is eminently suitable, it being perennial and profiting by frequent watering. In this system, the plant is grown along low ridges, and the shallow hollows or depressions between are used for distributing the water much the same way as for furrows. After cultivation is, of course, essential, care being taken to preserve the shape of the corrugations. Owing to the permanent character of the furrows, watering is much simpler and more certain. Once in working order and the irrigator familiar with his ground and its requirements, water may be turned on into the head ditches and allowed to distribute itself, saving a lot of labour and annoyance.

In the spreading system, distributing channels are run along contours, that is on lines of the same level, at distances of several chains apart. The water is let out from a distributary by any of the means already described and at frequent intervals; it is allowed to flow slowly over the surface to the next contour channel which picks up any surplus. When well arranged, the result should be the same as in the furrows, very little reaching the end beyond that required to soak the soil in the immediate vicinity. If the land has been well graded and levelled, this is a fairly simple operation and the water will need but little coaxing or blocking with the long-handled shovel to spread over the whole surface between the contour drains. Plenty of labour at the outset in land preparation and efficient system will tend to greatly reduce the labour required in distributing, and as the latter is a continuous expense, no pains should be spared to reduce it to its lowest limits compatible with good work.

The flooding or check system comes next in order of merit. Check banks which are advisably made low and wide so that implements may be worked over them, and at intervals to allow 6 inches in depth of water at most being put on the land. In somewhat undulating country the check banks may with advantage be run on the contours, each being 4 inches lower, the water being about flush with the top of the check bank. With the section generally adopted, narrow and high, there is a considerable liability to break away causing a loss of water and damage to crops. If the ground is tolerably level, the check banks may be run in straight lines, to suit cultivation and harvesting, inclosing from 5 to 10 acres in each check. This brings the description of distributing systems to a conclusion, for the letting of water on to a paddock to find its way as best it can over the surface, forming islands and leaving pools is not a system, though unfortunately only too common in practice. Too much stress cannot be laid upon the three cardinal requirements for successful irrigation: preliminary grading or levelling of the land to be watered; allowing sufficient time for thorough soaking; and surface stirring as early as possible after watering.

In all cases see that the seed bed is moist. Land may be watered before ploughing or after; but the moist seed bed is essential. It may, of course, be due to natural causes without any watering. For winter crops, the next watering depends upon the season. It may not be needed until late in September, and sometimes not at all. A third watering is rarely called for. For summer crops water seed beds as before, then give another watering about a fortnight after sprouting, and a third in a four weeks or so as the season requires. This should be sufficient to give a full and mature growth. In the case of lucerne, a watering should be given immediately after each cutting, and then get to work with the harrows. This, with favourable conditions, may mean that five or even more waterings may be needed. For fruit trees, four waterings at most will do, save in exceptional seasons, and vines do with one less. Crops of the market garden order wlll probably require more frequent attention, but as they will in general be of small extent only, they can be sufficiently satisfactorily dealt with. If supplies are drawn from a public

channel, provision will need to be made to store some water for this purpose as the channel will, in all probability, be empty for longer intervals than the plant will stand. Tanks are chiefly constructed, and with a pump available, the soil may be used to form a basin above the level, from which the water may be gravitated as required.

The above notes will serve as a general answer to the queries given at the head of this article, but it is well to remember that only broad principles can be given the cultivator on paper. The irrigator himself must solve most of the problems—and they will not be few—that will arise. Hired labour will seldom be satisfactory. The successful irrigator will always be the small holder who can give his personal attention to a small area and work it thoroughly. As for the larger holders, profits are to be made even with rougher and cheaper methods of distribution; but not to the extent possible with the smaller man.

As a parting word, never let the water touch the stems of growing plants in hot weather, else you run serious risk of injury to the plant. As to results to be aimed at, if fruit growing is the selected way, little improvement is possible upon the existing methods of cultivation and watering in vogue in Mildura and in the Goulburn Valley. If fodder and its conservation into animal products per medium of the cow or the sheep is chosen, then use all endeavours to get a good standard of lucerne. Do not graze, but cut it and hand feed; and prepare to cut it out at intervals of from five to eight years and resow after an interval of other crops.

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By J. C. Willis.

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A FLORAL PARADE FOR COLOMBO.

BY J. C. WILLIS.*

In a land that is fond of "Tamashas," in which flowers are fairly easily and plentifully to be obtained, and in which motors and other vehicles are abundant, there is a good deal to be said in favour of holding a "Floral Parade" such as that which was held in Honolulu on February 21, 1908. An account taken from the "Hawaiian Star" is subjoined, as well as a list of prizes.

Writing to Mr. L. G. Blackman, Editor of the *Hawaiian Forester and Agriculturist*, to whom I am much indebted for his kindness in sending me papers about it, I received a book of pictures showing the prize cars, &c., which were one mass of flowers, as well as the proccssion leaving the State House.

Mr. Blackman in a letter says :—

"With regard to the chief desiderata to make such an undertaking successful I would recommend the following :

Its occurrence upon a public holiday.

Appointment of a small energetic committee of organisation with small sub-committees for the various departments.

Prizes for each class of competing entrants.

A general rendezvous on day of event for the judges to examine, and to allow the contestants to be arranged properly for the parade. For this latter purpose, names of contestants should be required a few days before, and places reserved for each in the line of march. A good plan is to stake out, or mark with whitewash on the roadway, an allotted place for each entrant to take position before the parade is set in motion.

A grand parade of the contestants, with finally a distribution of prizes.

Paper flowers should be either barred or placed in a class by themselves."

Such a parade should be a very successful event in Colombo, held say in January, and should add to the attractions of the town during the town season, and encourage the keeping up of good gardens. We would suggest that every kind of vehicle have a class.

* Written early in 1909.

THE GREAT FLORAL PARADE.

Citizens of Honolulu are enthusiastic in comment on their 1908 Floral Parade. As it wended its way through the streets this morning the crowds didn't seem to know which part to cheer the most, and after it was over the general verdict was that it was "the best yet," and that it was an exhibition to be very proud of. The weather was perfect, and a full, clear sun brought out the full brilliancy of the splendid colourings of the parade.

The start was quite prompt at 10 o'clock, and there was little interruption after the first head of the parade moved. Some difficulty was caused by street cars, which did not stop the schedule service, and especially they interrupted the picturesque pa-u riders in their gallop along King Street. The spectacle, on its own scale, was declared to compare well with Mardi Gras or any other event of the sort to be seen, and the pleasure of the public was expressed on every hand. Floral beauty, feminine beauty and the picturesque and the comic elements were all in the line, and the happy result will add to public interest and enthusiasm for the next parade.

The streets along which the parade passed were lined by large crowds, who cheered the various striking floats as they passed.

Punahou College grounds were crowded long before the parade arrived, and a handsome sum must have been realized as an entrance fee of 25 cents was charged.

The judges of the various divisions had places roped off for them on the Ewa terrace of Bishop Hall, and about this the crowd assembled in a dense throng. The police kept the drive in front of the judges' stand clear, however, and the parade reviewed slowly before this.

After the winners had been announced by the judges, these returned over the course in review, and as they passed they were photographed by Bonine with his moving picture outfit. The sun was shining brightly the while, and conditions presaged an unusually successful set of films.

The Oahu College pageant, which attracted a great deal of attention, was

a reproduction of the May-day parade given by the pupils of Punahou last spring.

A few minutes after 10 o'clock the bugle call to start was sounded by Joe Leal mounted on a prancing charger, and the third annual Floral Parade was in motion. Charles F. Chillingsworth mounted on a gray horse assisted by L. Petrie led the parade followed by five young men mounted on bicycles, the cycle decorations being very good. One tandem was supposed to represent a boat, the entire hull being done in red and white, while the riders were dressed as sailors. Following the bicycle riders came the island princesses headed by Miss Emma Rose, who looked very well with her herald and other members of her suite. Next came the princesses of Maui, Oahu and Kauai in the order named. After the princesses came the pa-u riders in command of Judge Frank Andrade, followed by a large number of other riders consisting of Punahou riders, cow boys, juvenile pa-u riders and others mounted on prancing steeds.

After the parade had wheeled into King Street it marched to Nuuanu, up Nuuanu to Vineyard, through Vineyard to the Queen's Hospital grounds to Punchbowl Street, where the automobile section left the other part of the parade and proceeded to the Punahou grounds.

The rest of the parade marched down Punchbowl to King, and out to the Punahou grounds where they joined the automobile section.

The cars in the All Nation section were as follows:—

1.—Governor's car decorated with American and Hawaiian flags driven by C. de Lovelace. The passengers were Governor and Mrs. Frear, Misses Virginia and Beatrice Frear and Miss Dorothy Smith and Master Harvey Hitchcock.

2.—Hawaiian car decorated with maile and ilima representing the period of King Kamehameha I, L. Palenapa as Kamehameha, and Arthur Aiwohi, Boki and Mrs. Fern as his suite. Palenapa's personation was fine and was much cheered.

3.—Portuguese car, driven by A. W. Seabury, decorations blue and white; flowers with the royal arms of Portugal on the back of the machine, Mrs. Seabury was the only passenger.

4.—Japanese car, representing Fujiyama, the whole car being in brown with pine trees at the base, and white effects to represent snow at the top.

5.—Japanese car, decorated with yellow flowers and yellow fans driven by Nakamura, with two young ladies dressed in Japanese costumes as passengers.

6.—Chinese car, representing a dragon and other Chinese characters, driven by E. H. Lewis, and having as passengers Hang Chack, Lum Chung Wo., Jr., Look Chock and the Misses Ngan Hong Quon and Sai Hong Quon dressed in Chinese costume.

7.—British car, driven by George Davies, representing John Bull and Britannia with the Royal Standard of Great Britain and other English flags. George Davies, dressed as an English huntsman, while James Wilder was dressed as John Bull with Miss Dorothy Ellerbrock standing, her right hand resting on a large non, representing Brittania.

8.—Italian car, driven by Blackman, decorated with the Italian colours, and having as passengers Miss Irmgard Schaefer and Mesdames Humphris and Wilder.

The School section autos were:

Six Kawaiahao girls in Quinn's car representing their different nations in the school, each in their National costume, the car being decorated in blue and white, the colours of the school. The nations represented and the names of the girls follow: Wattie Robinson, Hawaii; Josephine Olmes, Portugal; Marie Hong, Korea; M. Salamanca, Philippines; S. Hashadate; Japan, and Sen Lan Ching, China.

Iolani School, J. A. McLeod, driving, decorated with colours of the school, red and white, having as passengers the Rev. Mr. Bliss and four students.

St. Andrew's Priory, A. Gartley's car, having five young girls from the school dressed in yellow and black, the car itself being decorated with ilima colours.

Mills Institute car, decorated with Oriental colours and flags, the passengers of the car being dressed in Oriental costume.

Methodist Korean School, Clarence Cooke driving, the car representing a Korean pagoda and the passengers being dressed as Koreans.

Aliiolani College, Alexander Young's car, representing a Hawaiian canoe, the five boys from the college being dressed in Hawaiian costume, Maile and ilima as decorations.

Kamehameha School, J. B. Castle's car, driven by Schoening, the car being decorated in red, the five passengers being boys from the school dressed in the uniform of the school.

Punahou car, decorated with the colours of Punahou, yellow and blue; the ladies of the school being dressed in yellow with blue ashes. Stanley Kennedy was driver, while the young ladies in the car were the Misses Kennedy, Langton, Smith and Hind.

The Committee in charge was as follows:—

A. Gartley, chairman.
R. H. Trent, treasurer.
C. F. Chillingsworth, marshal.
L. Petrie, assistant marshal.
Geo. R. Carter, automobiles.
A. J. Campbell, carriages and vehicles.
S. M. Ballou, all nations.
Gerritt P. Wilder, Inter-Island Hawaiian Princesses.
Frank Andrade, pa-u riders.
W. A. Greenwell, riders other than pa-u.
John Hughes, arrangement and grounds.
H. E. Cooper, social clubs.
Albert Afong, prizes and decorations.
J. H. Soper, tickets.
J. B. Freitas, bicycles.
A. F. Griffiths, schools and colleges.

Private automobiles were in line as follows:—

Mrs. George Fairchild was driving her own car, the whole car being tastefully decorated with violets. Huge bunches of violets were at each end of the car, while the ladies were dressed entirely in violet carrying violet coloured parasols. The passengers being the Misses Helen, Alice and Lady Macfarlane.

Alexander Young's car had Alexander Young, driving, the whole car being in blue, with butterflies and hydrangeas. As passengers Mr. Young had Mesdames R. W. Anderson, A. A. Young, A. Berg and Miss Pauline Young.

United States Marine car was decorated with the American flags entwined with red and blue bunting, the colours of the Marine Corps. The name U. S. S. Marines in yellow flowers was on both sides of the car. Harry Wilder drove and had as passengers seven marines in full dress uniform.

Kunalu Boat Club's car was decorated entirely in yellow and white, the colours of the club. Oars and life preservers were also used in the decorations. Jack McCandless drove the car, and had for his passengers the Misses Angus, Hall, Lucas and Catton.

Colonel Sam Parker's car used by the Hawaii Promotion Committee was decorated in the national colours, having as its passengers F. L. Waldron, W. T. Lucas and James McLain.

Car representing legend, "Remnants of Robin Hood," was entered by T. Clive Davies. The passengers were Miss Muriel Davies, Maid Marion; Miss Gwendolen Davies, Allan-a-Dale's bride; Master Brian Davies, Master Arthur Davies. Car was driven by T. Clive Davies.

Mrs. L. Abrams' car, driven by Mrs. Abrams, was decorated entirely in yellow poppies representing California. On the front of the hood two brown "Teddy Bears" stood guard. The ladies in the car were dressed entirely in yellow, they being Mesdames Crane, Soule and Arendt. Fifteen thousand flowers were used in the decorating of the car.

S. R. Jordan, driving his own car, which was decorated in blue and green morning glories, had as his guests Mrs. Hugo Herzer and the Misses Jordan, Spaulding and Restarick.

W. E. Brown's car, known as the "Brownie car" and driven by himself, was decorated with sunflowers and paper berries. As his guests he had Masters Stanley Mott-Smith, Ernest Mott-Smith, Jr., Ernest Peterson and Everett Brown.

C. C. Von Hamm, who received first prize for Class C, had his car decorated representing a basket of violets, the entire car being one mass of the beautiful flowers. Mrs. Von Hamm was his only passenger.

William Schuman, who had his sister Miss Myrtle Schuman as his passenger, and who received second prize in the Section C class had his car entirely decorated with pink and white chrysanthemums.

The "Nervy Nat" brothers in their ancient Venetian Gondola with everything to match were one of the features of the parade. The car looked the part as did their owners. Old Venetian shutters, wooden staves where the hood should have been, were only some of the things that were on the car. A chicken coop on the rear in case of a break down was another feature of the make-up of the car The two nerve brothers were at their best during the entire parade.

Judge Kingsbury and Mrs. Kingsbury had their car decorated only with the American colours. Mrs. Kingsbury was entirely in white.

The three Mardi Gras cars entered by the Kilohana Art League were driven by Messrs. Schaefer, Brown and Hodgins, each car being in a different colour. All the drivers as well as the passengers were masked.

Mrs. George Ross's car driven by Donald Ross and Miss Creighton as passenger, was decorated with sugar cane stalks and looked very pretty. Both of the occupants had sugar bags as their costumes.

The "Prosit" car owned by Edgar Henriques and decorated to represent a huge cask was one of the best features in the parade. The members of the Anti-Drink Club Messrs. Hall, Martin, Bergstrom, Reinecke, O'Neill and Doyle were dressed as they were at the time of the baseball carnival. During the entire parade they were drinking, but no one knows what.

"The car that once through city streets" belonging to Judge Ballou was driven by Frank Thompson, the motive power being a pair of old mules that have been here since the first mules arrived in the early 40's. In the old relic of better days were Billy Roth, Billy Walker, Billy Williamson and Dr. Smith of the Naval station. An old funeral trapping was on the back of the car, while bunches of crape were placed at different parts of the car. The mules were draped in black, while the passengers wore bands of crepe on their left arms.

THE PRIZES.

Prizes to automobiles were awarded as follows, according to class, and the prize pennants distributed to the winners by Mrs. Governor Frear:

Section A—Large touring cars:
- First—Alexander Young.
- Second—Mrs. George C. Fairchild.
- Third—Kunalu Boat Club.
- Honorable mention - U. S. Marine Corps.

Section B—Small Touring cars:
- First—Mrs. Louis Abrams.
- Second—S. R. Jordan.
- Third—Willard Brown.
- Special prize to T. Clive Davies.

Section C—Runabouts:
- First—C. C. von Hamm.
- Second—William Schumann.
- Third—Kilohana Art League (Gus Schaefer).

Section D—Comical Automobile:
- George and Richard Cooke.

Comic Section, Vehicles:
- Lunalilo Home Float.

Comic—Riders:
- Horse wearing pants.

Vehicles—Multiple team:
- E. H. Lewis (with band).

Four-in-hands:
- First—San Juan Hill.
- Second—Army transportation wagon.

Double teams:
- Sam Parker.

Single teams:
- First—C. W. Macfarlane.
- Second—Tom Hollinger.

Surreys:
- A. J. Campbell.

Tableaux Floats:
- Kilohana Art League.

Fire Departments:
- First—Hose and Engine No. 4.
- Second—Hose and Engine No. 2.

Bicycles:
- First—Tandem boat, Gilliland and Rodrigues.
- Second—Boy on blue and white decorated wheel.
- Third— Goat cart.

Most Original:
- Bicycle Fish, Freitas.

Most comical:
- Harvey Canilton (tramp character).

Pony and Juvenile Turnout:
- First—Marjory Gillman.
- Second—Marian Stacker.

Other Vehicles:
- Horse propelled auto, F. E. Thompson.

Island Princesses:
- First—Oahu—(Mrs. Mignonette Myers).
- Second—Maui—(Miss Alice Bartholomew.)
- Special mention, Hawaii (Miss Emma Rcse).

Comic Section, Vehicles:
- First—Wash wagon.

Flowers, Island Princesses:
- Hawaii, Lehua; Maui, Red Rose from Iao Valley; Molokai, Kukui; Oahu, Ilima; Kauai, Mokihana.

Pau Riders:
- First—Mrs. Hilo.
- Second—Mrs. Kapulani.
- 3rd—Mrs. Walanika.

Cowboys:
- First—John Fernandez.
- Second—Sonny Gay.
- Third—Ernest Gonsalves.

Juvenile Cowboys:
- First—Monsarrat.
- Second—Walter Grace.
- Special prize, Harvey Holt.
- Special prize for Riders to Mr. Kilinahi.

Best appearing couples, ladies: Miss Wattie Holt and Miss Anabel Low; Miss Rosie Herbert and Miss Lucas.

Best appearing couple: Miss Ross and Mr. Lishman, first; Miss Smith and Mr. Clark, second.

Juvenile Girl rider: First, Miss Ross; Second, Miss Herbert.

Juvenile Boy riders: First, Master Douglas Damion; second, Master Clark Pratt.

Coric Ride:—Mr. Freitas.

The prizes for all except the bicycles and juveniles were handsome pennants of

blue, red and yellow, first, second and third in the order named. The prizes other than these were from one to five dollars in cash.

DEPARTMENTS OF AGRICULTURE AND THEIR FUNCTIONS.

(From the *Agricultural News*, Vol. VIII., No. 179, March, 1909.)

The functions of Departments of Agriculture are numerous and varied; it is desirable, therefore, from time to time, to review them in order to ensure that all are properly exercised.

Some of the chief functions of a Department of Agriculture are to collect the results of experimental work that is in progress at the stations under its control, to keep in touch with investigations carried on elsewhere, and to include in its organization suitable means for diffusing the knowledge thus accumulated.

The last named point is most important in agricultural work, and more especially in regard to tropical agriculture. The great diversity of the whole subject, and the fact that a good deal of knowledge has been placed on record which, however, is not yet accessible in text-book form, but is scattered in different journals and other publications, together with the further fact that the fund of information is constantly being added to, all combine to make the collection and diffusion of results a very prominent part of the work of an Agricultural Department. It is not enough that the knowledge exists, it must be made available to those whom it most concerns, and every effort made to adapt it to local conditions. The men most interested—planters and farmers—are frequently too busy or unable to hunt up required information from out-of-the-way sources, hence the value of a central agricultural office, with its organized sub-stations and staff of officers, which recognizes as a chief part of its duty the necessity to indicate where facts needed are to be found, and to make them easy of access to all.

A planter working alone encounters many difficulties and stumbles upon many problems interesting or perplexing, he may expend much time, thought and energy upon these, he may even experiment and alter his methods of working as the result of these efforts. All this is time-consuming and the results are uncertain. If he is in touch with a well-equipped Department he can at the outset explain his difficulties or views, he can then learn whether these points have already received attention, either in his own neighbourhood or elsewhere, and his line of action can be directed by the information thus made available, Should his difficulties or views be new, he can have laid before him the general principles underlying the questions at issue, and his thoughts, experiments, and work can be directed in right channels. Erroneous ideas will be eliminated and sound ones encouraged, and thus the departmental assistance may make for continuous progress with the minimum waste of energy.

The usefulness of agricultural experiment work cannot be lightly estimated, since by its means the stock of definite knowledge is increased, but it may safely be stated that much of the value of this work would be lost, were it not for the continued existence of central Agricultural Departments and the organized staff of officers at the outlying stations, whose duties keep them in touch with the work of planters all the year round. It is not enough to issue periodical reports on the results of experimental work. Planters seldom assimilate all that appears in the reports brought before their notice, even when these deal with their own subject; they may, it is true, read such publications carefully, but the points picked up in this reading appeal to the mind according to the particular work in hand at the time, or the bent of the mind at the moment. As a result, much valuable information that is contained in reports and occasional papers is often passed over and forgotten, simply because it is not immediately applicable.

The facts would be noted as being useful if read at a seasonable time, or when the subject in question was occupying the mind of the reader ; but under other circumstances no impression is made and the results of the experimental work are in danger of being lost.

It is, however, the function of an Agricultural Department, not only to carry out experiments but to use every effort to see that the results are applied by the planters concerned. The points elucidated therefrom are again brought to the notice of the planter by officers of the department, and emphasize at the time when the work in question is calculated to be of value, or its application appears opportune. Indeed, planters themselves rely on the departmental officers to point out the application of the latest experimental results, and to be ready to give specific information if asked for it, and progress is probably largely determined by the

readiness with which this exchange of thought takes place.

An up-to-date Agricultural Department, therefore, whose operations ramify in different directions, and whose officers are in touch with each other, so that there is a continuous interchange of ideas, finds one of its most valuable functions as a collector and distributor of information. Knowledge, which may exist in the minds of isolated individuals, and which would otherwise have but a limited use, is brought out and made available for the service of all. From this point of view the existence of the central and sub-central officers and stations must be regarded as being most valuable, and even necessary, since it ensures that the results of research are not lost, that they are put to the test and modified to suit local conditions, and that they are continually being kept before the notice of those whom they immediately concern.

It may be pointed out that this work of taking existing knowledge and making it available for general use is one which may perhaps be regarded as being more valuable, and more practically remunerative to the general body of mankind even than the creation of knowledge itself. Much useful knowledge may lie stored up and unused for lack of an intelligent guide to its existence and usefulness, while its proper diffusion may change the current of thought of a community or class of workers and immediately prove remunerative and of tangible value. What better instance can be cited than that of Mendel whose discovery lay hidden in *The Proceedings of the Natural History Society of Brünn* for nearly forty years? As soon as his work was brought to light and adequately made known, it was immediately fruitful of great results, the full importance of which is probably yet unrealized.*

It is important that those in administrative charge of affairs should recognize the value of organisation for the purpose of diffusing knowledge—agricultural and otherwise. They are often prone to think that its useful facts have once been placed on record that is sufficient, and that in the usual course of things they will be discovered and applied by those locally interested; but this is seldom the case. Progress in any given line of work is immensely hastened and rendered both easier and more certain by the existence of organizations whose duty it is to collect, co-ordinate, classify and diffuse knowledge. In agricultural work this implies agencies of many kinds, reaching out on the one hand into the fields and into close touch with the daily work therein, and culminating in a central organization capable of the duties outlined above. Such a system is well exemplified in the agricultural organizations of various countries, but perhaps nowhere to greater advantage than in the magnificent system of the Department of Agriculture of the United States, which is proving of incalculable value to that progressive country.

*See *Agricultural News*, Vol. VIII., pp. 33-4 and 49-50.

SECOND "MASTERS" LECTURE.

THE PRODUCTION OF HORTICULTURAL VARIETIES.

(From the *Gardeners' Chronicle*, No. 1,188, Vol. XLVI., Saturday, October 2, 1909.)

On Tuesday last, Prof. Hugo de Vries delivered the second "Masters" Memorial Lecture before a large audience at the Royal Horticultural Society's Hall, Vincent Square.

Mr. A. D. Hall, F.R.S., who occupied the chair, in briefly introducing the lecturer, referred to the purpose of these lectures, which are intended to keep alive the memory of the late Dr. Masters, and to bring before the horticultural world the researches of science as its discoveries bear upon the practice of horticulture, and thus to continue the work—the application of science to horticultural practice—which Dr. Masters never lost an opportunity of furthering.

Prof. de Vries, in his first lecture (see *Gardeners' Chronicle*, June 26, 1909, p. 419) dealt with Dr. Masters's own researches in vegetable teratology; in this one his subject was mainly his own researches into the origin of horticultural varieties. He pointed out that Darwin's work on the "Variations of Plants and Animals under Domestication" had led the way for prolonged investigation in showing how great a significance attached to these variations in supporting the theory of evolution. Varieties may be regarded as "small species," *i.e.*, groups of plants differing from one another in only one or at most a few characters, but differing so that if their origin were not known, some botanists would regard them as distinct species.

If, as will be generally admitted the facts of variation strongly support the argument for evolution, the lecturer pointed out that the process by which variations arose in all its details became

a most interesting and important subject of enquiry. While the actual manner in which species are produced in Nature may differ, and it probably does differ in details, from that in which varieties are produced in horticulture, yet the laws governing the process will be the same in both cases. In "fixing" the varieties which arise in the garden, there is generally the difficulty of guarding against cross-pollination, since numerous closely-allied forms are usually cultivated in close proximity to the new form, and there is the fact that many of the variations it is desired to reproduce and develop are only faintly indicated at first, as in the cases of doubling of flowers or variegation of foliage. Only after careful selection and constant care do such variations become so marked as to ensure a sufficient contrast with the species from which they were derived to make them worth cultivation as novelties.

There are thus two types of varieties with which the horticulturist has to deal—the "constant" variety and the "ever-sporting" variety. The former type, Prof. de Vries calls "mutants," and in reply to a question, pointed out that "mutants" differ from other variations, fluctuating variations as they may be called, in that the former arise suddenly and not by small degrees, and when they have once appeared they "breed true" to their new characters provided they are self-pollinated, while varieties formed after the tedious, oft-repeated selection of small differences, differences depending very often upon methods of cultivation, belong to the "ever-sporting" type.

Good examples of "Mutants" are furnished by white "sports" of many flowers and by dwarf varieties. With these the florist's work in fixing lies in securing isolation, and if isolation be complete, the fixing is accompalished in a single year.

The extent and even the occurrence of variegated Horse Radish depends largely upon the method of cultivation, and, the extent of doubling seen in other plants may vary enormously even on a single plant at different seasons of the year. These afford examples of the "ever-sporting" varieties. Such varieties may arise fully developed or may appear only by steps. Small indications of possibilities appear first, and the florist has to isolate them and "work them up" by constant selection of the most marked variations in the desired direction.

The lecturer then went on to show how varieties have been produced under his own observation in plants whose histories had been known for many generations.

His first example was the peloric form of the common Toad Flax. This form has, in all its flowers five spurs, instead of only one spur as seen in the common type. It has been found in a considerable number of widely-separated places under circumstances that leave no reasonable doubt that it has been produced from seed of the common type It rarely produces seed, but, being perennial, is able to hold its own for a considerable number of years, though it may finally disappear. Prof. de Vries sowed seed of the common type in his garden and watched the progeny through eight generations, always excluding the chance of cross-fertilisation, without observing any change whatever. In the ninth generation, however, a plant bearing peloric flowers suddenly appeared. Thus a sudden variation had occurred under his own observation without any previous indication of deviation from the type. The seed he was able to save from this abnormal specimen reproduced the variation, and similar variations had arisen from succeding generations at intervals.

In like manner he had seen sudden variations arise in Œnothera biennis, where a form with very narrow petals, which he had called "cruciata," had appeared, and in the Dahlia, where the tubular corollas were darkly coloured inside instead of outside, as is usual.

As an example of an "ever-sporting" variety, the lecturer gave an account of the experimental development of the Double Corn Marigold (*Chrysanthemum segetum*), since double flowers of Compositæ form an excellent example of "ever-sporting" variations.

The seed in this case was derived from the large-flowered garden variety, in which there are on an average twenty-one rays, though the range of variation in number is up to twenty-four and down to nine. In the fourth year, by selecting flowers showing the largest number of rays each year, the average was raised to about one hundred. It might have been expected, said the lecturer, that the average number of ray florets might be increased by this process of selection, but there was also the chance that a double variety might be secured, and this was actually the case, for in the fifth year one was secured in which about two hundred rays were present in the head. Thus, by selecting what was at first a slight variation from the normal, and breeding from those of its

progeny which showed the greatest development of that variation, a fixed double form was at length reached.

Another instance of an interesting "ever-sporting" variety was afforded by the race of five-leaved Clovers which the Professor had succeeded in establishing.

The case of "mutants" in Œnothera Lamarckiana, to which the lecturer next referred, afforded an instance of not one, but several new forms, arising suddenly in one generation from seed of one plant. About a dozen of these "mutants" could be relied upon to appear each season; the number of different "mutants" is, of course, not unlimited, but the same novelties spring from it almost every year, and in cases where they can be got to produce seed by self-pollination, they breed true.

One of the most interesting of these "mutants" is the dwarf form known as *nanella*, which, though much shorter in the stem than the type, bears flowers quite as large and is, therefore, very showy. This form appears in the proportion of about 2 per cent. of the seedlings from Lamarckiana every year.

Another "mutant" named *lata* has weak stems, and much broader leaves of a paler green colour than the type, and with rounded tips, while a form known as *albida* is also fairly common, and, like others, may be distinguished from the type even in the seedling stages; it has narrow, whitish leaves. Many other mutants have occurred and usually re-occur among the seedlings of Lamarckiana every year.

THE DISCUSSION.

Professor Percival raised the question as to whether there was any periodicity in the occurrence of the periods during which mutations occur, suggesting that perhaps every ninth, tenth, or twentieth generation or so might see their recurrence in certain species. Mr. Druery also referred to this question, basing his remarks upon his experience among the many "mutants" which occur naturally among British Ferns. Prof. de Vries thought that perhaps fifty generations might be nearer the period at which mutations might occur, but pointed out that the question must be pursued for a long period, in order that it be answered. So far no answer could be given.

Mr. C. C. Hurst expressed his obligations to the lecturer for his lucid lecture, and emphasised the importance of the facts Prof. de Vries had stated, namely, first that "mutants" were general variations which breed true so long as they are isolated, and, secondly, they were of sudden occurrence completely developed.

The Chairman, in conclusion, thanked Prof. de Vries for the lecture, and expressed the hope that all who are in any way employed in raising new varieties of plants will keep careful records of their work, for, in order that greater knowledge of the laws that underlie the causes of variation may be obtained, there was abundant need for experiments to "watch, wait and record."

THE PHILADELPHIA MUSEUMS.

(For the Season 1909-10.)

The Philadelphia Museums continue to offer to the schools of Philadelphia the privilege of bringing classes to study its collections from foreign countries and to listen to lectures along the line of their geographic work.

Visits to the Museums are most profitable to the children after considerable study of a country or region in the school room.

At a time selected by the teacher, a class or grade may be brought to the Museums where they will be given a lecture on the subject selected from the accompanying lists.

Each lecture is profusely illustrated by coloured lantern slides. The lectures are adapted to the comprehension of the children who attend, those to the lower grades being given in very simple language.

At the close of the forty-five minute lecture the class will be divided into sections, and accompanied by guides, will be shown the products, manufactures and materials which appertain to the country or countries on which the lecture has been given.

The visiting classes should be restricted to not more than about one hundred pupils.

DATES FOR VISITS.

It is necessary for those who wish to take advantage of these opportunities to arrange for dates and to select subjects in advance. If arrangements are made over the telephone, Preston 4798, call for the Curator, Mr. Chas. R. Toothaker. If by letter, address the Philadelphia Museums, 34th Street below Spruce Street.

Nearly all schools find it convenient to visit the Museum in the afternoon, arriving at about 2 p.m. If any other time of day is more convenient, arrangements can be made accordingly.

In accordance with a provision of the Board of Education, the Superintendent of Schools, Dr. Martin G. Brumbaugh, is authorized to grant to teachers and classes permission to visit the Philadelphia Museums once a year for half a day, upon the written request of the Principal.

LECTURE SUBJECTS.

For Fourth Grades.

THE UNITED STATES.—Some of the most important plant, animal and mineral products; important industries characteristic of various parts of our country; lumbering in the north, south and west; fishing for cod, salmon, etc., in Atlantic and Pacific; cotton and sugar production in the south; grain fields and cattle ranches of the middle west; fruit raising in California and Florida; mining in the Rockies and Alaska; iron, coal and petroleum in Pennsylvania; glimpses of interesting natural features, Niagara Falls, the Yellowstone, etc.; types of the inhabitants of various regions.

Note.—This lecture is necessarily very general. Teachers preferring to do so can arrange for separate lectures on the *Southern States or the Western States.*

Wheat from the Seed to the Table.—Cultivation, harvesting, transportation and manufacture of wheat and flour in the United States. It will be the aim in this lecture to draw attention not only to wheat and flour as important materials of commerce and to the machinery and processes employed in wheat raising and manufacture, but also to the occupations of men in agriculture, manufacturing, transportation and trade.

For Fifth Grades.

THE WEST INDIES.—Especially the beautiful islands of Cuba and Porto Rico—sugar, tobacco and tropical fruits; the people, their manners, customs and occupations; cities and towns; means of transportation.

SOUTH AMERICA.—Principal cities; people, manners and customs; industries and productions; coffee and rubber in Brazil, wheat and cattle in Argentina, cocoa in Ecuador, mining in the Andes. Some of the most interesting plants and animals; the great forests, plains and mountains; the Andes and the Amazon.

NOTE.—Teachers desiring to have a single country or section treated in greater detail can arrange for a lecture on *Venezuela, Brazil, Argentina, Chile, Peru, or the Andes.*

For Sixth Grades.

INDIA.—Life and habits of the people; caste; curious customs; characteristic scenes in the large cities; bazaars; palaces; important industries, such as tea, rice, coconut, spices, mining; tigers and elephants; glimpses of the rivers, forests and mountains.

JAPAN.—Native life in city and country; foreign influence; manners and customs; residences and shops; temples and idols; the growing of rice and tea; camphor; silk culture; pottery and art work; bamboo and other forests.

CHINA.—A trip through the Celestial Empire; Pekin, Hongkong, Canton, and other cities; native shops and foreign quarters; canals; temples; country villages and farm life in the far interior; the culture of tea, rice and opium; curious means of transportation and other features of interest.

For Seventh Grades.

SOUTH AFRICA.—Cape Town, Kimberley, Johannesburg, Durban; farming industries, fruit, wine growing, grain, cattle and sheep; the diamond mines, the gold workings, coal deposits; Boers, English, native black races; the Cape to Cairo Railway; the wonderful falls of the Zambesi.

CENTRAL AFRICA.—The Congo and the Niger; native races, their manners and customs; cities and villages; the jungle; palm oil and rubber; wild animals.

PHILIPPINES.—Civilised Christian people of the north and central islands; the Moros of the south; heathen tribes; manners and customs; Manila hemp, coconut, rice, resources and industries; education.

AUSTRALIA AND NEW ZEALAND.—Principal cities; civilised and native people; occupations; agriculture, stock raising; mining; the Barrier Reef, pearl fishing; kangaroo and rabbit; the desert of the interior; commerce.

For Eighth Grades.

Any of the subjects listed for the lower grades may be selected. The lectures will be more extensive, dealing more fully with our trade relations with the country considered, and the important products exported.

In addition the following subjects touching on the whole world are arranged:—

Forests and Lumbering.—The forests, important trees, and methods of cutting and getting them to market, with glimpses of the lumbermen at work or in camp in different sections of the United States and Canada, Mahogany

getting in Mexico, Central America and Africa; teak in India; the forests and lumbermen of Japan, the Philippines, Australia and New Zealand.

The Forms of Carbon.—The Great diamond mines of South Africa, showing how the diamonds are taken from the ground, separated from the blue clay, graded and cut. The graphite pits of Ceylon. Coal mines and miners of Pennsylvania and other sections of the United States, of Europe and Australia. Petroleum wells and refining in various parts of the world.

Transportation in all Lands.—How people travel and carry their goods in different parts of our own land and in foreign countries. Transporting of commercial materials by men, by pack animals, and by primitive carts and boats in Asia and Africa; modern steamships and railways in Europe and America.

For Advanced Grades.

Lectures may be arranged on any of the special subjects enumerated in this circular, or on such subjects as Cotton, Wool, Sugar, Spices, Beverages, Rubber, Fisheries, Fruit Industries, etc. These lectures describe the production of the raw material, its preparation for man's use, the countries of production, and the importance of the material in the commerce of our own and other countries. Other lectures may be chosen on subjects of special commercial interest such as *Important Harbours of the World, Ancient and Modern Trade Routes, the Commerce of South America, Foreign Business Methods, etc.*

SPECIAL LECTURES.

Free Public Lectures on topics of popular interest will be given at the Museums as usual during the Winter.

See separate announcement.

Several School Extension Lectures will be given in the Museums' Lecture Hall during the winter as a part of the course offered by the Free Library of Philadelphia.

ELEMENTARY PRINCIPLES OF MANURING.

(From the *Indian Agriculturist,* Vol. XXXIV., No. 4, April, 1909.)

Plants, like all other living organisms, require nutriment, and according to the supply of this nutriment will their development be.

Plants absorb food in the fluid state only, either as gas or liquid. The gas is carbon dioxide ("carbonic acid gas") which exists in the air. A few plants are credited with absorbing nitrogen. The other nutriment is absorbed in solution in water.

If an ordinary plant be very carefully dug up with all the earth adhering to the roots, and the earth be then carefully washed off, it will be found that there is a main root (perhaps several). This main root branches again and again, giving off smaller roots, until finally very fine hair-like processes are seen: these are the "root-hairs," and through these root-hairs the plant absorbs all its liquid nutriment. A land plant without root-hairs cannot live; and hence the necessity of great care in transplanting young plants. Thus it is very important to have a loamy soft soil for these root-hairs to ramify into and obtain nourishment in the neighbourhood of the root.

Water.—Herbaceous plants may consist of from 60 to 80 per cent. of water, hence an adequate supply of water is essential. In arid districts the water question is the most important, but with energy the difficulty can be overcome to a considerable extent.

By a process known as "dry farming" a huge tract of barren land has been recently brought under cultivation in America. It was pointed out that soon after rainfall on this land, thousands of tons of water evaporated which might be retained in the soil if proper cultivation were practised. The process of retention consists simply of preserving a good open soil by deep cultivation and *constant hoeing of the surface* to preserve a fine tilth layer of well broken soil on the surface, which tends to prevent water coming to the surface from below to any great extent, and to keep it imprisoned in the soil for the use of the roots of plants. Of course "dry farming" means hard work, and the habits of the Indian cultivator are not ordinarily such as to benefit them for this kind of farming. *The hoeing has to go on continually.*

The following elements are essential to plant life, besides the elements mentioned above as contained in water, *viz.*, hydrogen and oxygen, and in carbon dioxide, *viz.*, carbon and oxygen :—

Non-metallic—Nitrogen, sulphur, phosphorus.

Metallic—Potash, calcium, magnesium, iron.

Nitrogen—Is a constituent element of what are called "nitrates." These nitrates usually resemble ordinary salt that one uses at table. Nitrate of soda or Chili saltpetre is an example of a nitrate; it is used as a fertilizer or

manure. This nitrogen in the form of nitrates is taken up in solution in water by the root-hairs of plants and is used to build up the tissue of which the plant consists, there is no plant not containing nitrogen in some form. To the rule that nitrogen is absorbed as nitrates in solution in the soil moisture, there is an apparent exception in the case of the leguminous plants. Legumes if grown in a soil devoid of nitrogen will yet find nitrogen which other plants would fail to do, the explanation being that on the roots of legumes there are to be noticed small "nodules," which, if examined, will be found to contain micro-organisms or bacteria or germs which take nitrogen from the air between the particles of soil and form nitrates, and these nitrates are then utilized by the plant roots as indicated above.

Nitrogenous fertilizers are applied to land as nitrates direct, *e.g.*, saltpetre, or nitrogenous organic matter, *e.g.*, decomposing cowdung, decomposing animal matter, etc. This nitrogenous organic matter is ultimately decomposed by certain germs into nitrates. Before this happens, the nitrogen is useless to plants or is "unavailable." Hence to render fresh farmyard manure, etc., a good fertilizer, it must be applied to land where there are plenty of the required germs living. Now these germs live preferably in a good open, warm or well-tilled soil, and not in a heavy unstirred unærated soil.

Sulphur—Is taken in by the root-hairs of plants as a soluble sulphate in solution in the soil moistures, *e.g.*, sulphate of ammonia, gypsum or sulphate of lime. Although gypsum is only slightly soluble, in time most of it finds its way into the plants; it contains the very useful constituent lime as well as sulphate.

Phosphorus.—This essential is taken in by the plant in the condition of soluble phosphate; although it is applied to land in such forms as bone-dust, bone-meal, ground bones, slag, superphosphate, etc. The phosphorus in bones is absolutely useless as it exists, or, in other words, it is "unavailable"; but when the bones rot as they do in a soil, though slowly, the phosphorus is changed to phosphates which are soluble and can then be taken in as plant food, when it is said to be "available." The finer the bone is ground, the more readily "available" is the phosphorus in it for food. Whole bones take years before being any good as manure, while bone-meal is much quicker in its action.

Calcium—Is an essential constituent of plants, but a very small quantity is sufficient. The great point about calcium (and lime) is that it is a stimulant, its presence in the soil rendering other ingredients such as phosphates, sulphates and nitrogen in organic matter more quickly available to plants. The lime decomposes complex substances with all these nutrient materials as it were locked up in them. The many virtues of lime have been set forth in this Journal, Volume I, No. I of 1907 (*vide* page 33).

Potash—Is an essential, and plants rich in starchy or sugary matter, *e.g.*, potatoes, beetroot and fruits are very fond of potash. Wood ashes contain a small amount of potash.

Magnesium and Iron—Are also essential, but only in very small quantities, so that all soils practically possess quite sufficient of these.

Chlorine and Sodium—Are held by some to be essential, but in other respects a similar remark applies as in the case of magnesium and iron above.

An application of any very soluble manure to land must be given with proper caution; because the very fact of its being soluble renders it more liable to be washed out of the soil in drainage water during and after heavy rain. Such a soluble and valuable fertilizer as nitrate of soda should be applied when the crop has germinated, and again later on, so that by giving two or three dressings the plant is able to absorb it instead of its being washed away. Where a slower acting nitrogenous manure is required sulphate of ammonia or farmyard manure, etc., is better because it is less soluble and, therefore, less likely to be lost, and the nitrates as they are formed in the soil are mostly absorbed at once on a well cropped area. From the above it is seen that if land rich in nitrogenous material be left fallow, the whole of the nitrogen is "nitrified" or changed into nitrates, and instead of being used by a crop these are washed out of the soil by heavy rain.

Superficially it would seem likely that if the average analysis of the plants cropped on a certain area of land was taken together with the analysis of the land, one would be able to get a clear insight into the requirements of that land; that is, however, not so, since analysis does not indicate how the various elements of plant constituents are existing in the soil, *i.e.*, whether or not they are in an "available" condition. Hence in all cases it is necessary to experiment by applying fertilizers containing the different plant foods, and to observe the result in each case both separately and with mixed fertilizers.

One of the handiest modes of procedure is to select six strips of land right up the length of a field and number them 1 to 6. To numbers 1, 2, and 3 apply phosphate; to 2, 3, and 4 apply kainit, which is potassium sulphate together with magnesium sulphates and chlorine; and to 1, 3, and 4 apply nitrate of soda; to 5 lime; and to 6 no manure. The plots will then be manured thus:—

(1) Phosphates and nitrate.
(2) Phosphate and kainit.
(3) Phosphate, kainit, and nitrate.
(4) Kainit and nitrate.
(5) Lime.
(6) No manure.

When the treatment that best suits the land and crop is ascertained, the whole area should be manured according to the result. An experiment should be next made to discover what minimum quantity of this fertilizer gives the maximum yield of good healthy produce.

The experiments indicated above have the advantage that they do not interfere with the ordinary working of the area and that they are quite cheap. The advantage reaped by the additional knowledge will depend on the future action of the experimenter. It must be seen in experiments of this sort that the strips manured differently are separated sufficiently to prevent any fertilizer obtaining access to a neighbouring strip and upsetting the arrangements.

To sum up, for all practical purposes in manuring a few experiments should be made to see that the soil contains (1) a sufficiency of organic matter, or "humus" as it is called, (2) potash, phosphates, nitrates, lime, and earthy moisture, and (3) warm pure air between the particles, as a result of good cultivation. This followed by (4) a good tilth, or pulverized surface, is what is required of every person who is interested in the production of good crops.

MARSHALL'S 30 H.P. OIL TRACTOR.

(From the *Agricultural Journal of India*, Vol. IV., Pt. III.)

This Oil Tractor is manufactured by Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, England, with the object of supplying a cheap mechanical power for agricultural purposes, which may possibly be useful in India.

The Tractor is fitted with a two-cylinder engine and has three speeds, 2, 4, and 6 miles per hour. The engine can be run on Petrol, Kerosine, Benzine, Gasoline, etc. With tanks filled with kerosine it can be run for ten hours continuously.

The engine is fitted with wide travelling wheels to travel over sandy ground. In working order it weighs approximately $4\frac{1}{2}$ tons and carries 25 gallons of fuel and 75 gallons of water; it is fitted with a water-cooler and a patent pump for circulating water through the cylinder jacket.

The engine can be used for ploughing, harrowing, cultivating, sowing, reaping and hauling; it can also be used for driving any fixed machinery such as threshing and winnowing machines, corn and cake grinding mills, chaff-cutters, etc., without any addition or alteration. This engine drives 3′ 6″ full size Marshall's Threshing machine fitted with Chaff fan, Bhoosa rollers and Bhoosa shifters continuously for five hours with a consumption of $1\frac{1}{2}$ gallons of kerosine per hour. One man is required to operate it.

Experiments in India show that it can plough $1\frac{1}{2}$ acres of land that has been previously broken, per hour, with a consumption of less than 2 gallons of "Chester Brand" kerosine oil, and uncultivated land at the rate of one acre per hour with the same consumption of oil.

The cost is Rs. 8,000. The Deputy Director of Agriculture, Bengal, saw the machine at work at Semapore and reported thus:—

"We were only able to test the ploughing, as there was nothing to thresh and no pumps or ordinary machinery to be worked. Soil tested by ploughing was sandy loam. Two four-furrow ploughs were attached to the back of the Tractor and 8 furrows 6″ deep and $9\frac{1}{2}$″ wide were ploughed at one and the same time.

"Ploughs:—Cockshutt's (Canada) Four Furrow: Plough cost Rs. 300.

Work done:—

9 acres in 7 hours.

Oil used:—

15 gals. Chester Oil.
$\frac{1}{2}$,, Petrol.
$\frac{1}{2}$,, Lubricating Oil.

Quantity of work done: Excellent.
Fuel:—Cost of working per acre:—

		Rs.	A.
Kerosine	...	8	7
Petrol	...	0	10
Lubricating Oil	...	1	12
		10	13÷9 Re. 1. 3.

Cost of fuel per acre = Re. 1.3. 13 acres can be ploughed per day of 10 hours.

Cost of working per day :—

	Per day. Rs. A.
1 mistri at Rs. 60 per month=	2 0
2 coolies ,, 10 ,,	0 12
	2 12
Cost of fuel per day (13 acres)	15 8
	18 4

Cost of working by bullocks :—

1 man and pair of bullocks= ½ acre per day.

1 man at ...	As. 6
1 pair of bullocks ,,	6
	12 per day.

To plough 13 acres per day would require 26 ploughs.

26×12=312, *i.e.*, Cost per day=Rs. 19.8.

Capital Outlay :—	Rs.
Oil Tractor and ploughs ...	9,000
Bullocks and ploughs ...	3,000

"Accordingly, without considering initial outlay, where ploughmen can be got at 4 annas and less per day, it is cheaper per unit to plough by means of bullocks.

"The Oil Tractor will not suit small holdings or paddy cultivation, but where large holdings of high land cultivation are concerned, and where labour is scarce and dear, the Oil Tractor is an economical motive power for ploughing.

"There is no doubt about the utility of this Oil Tractor. In addition to ploughing, threshing, pumping, sugarcane crushing and carting, etc., can be done, but in Bengal unless the holding is compact and 200 to 300 acres in extent, high land cultivation is concerned, and ordinary labour costs Re. 1 per head per day, it will be found there is no advantage in changing the ordinary system of cultivation now in vogue in the Presidency."—(EDITOR).

DEVELOPMENT OF SCIENCE IN HORTICULTURE.

(From the *Experiment Station Record*, Vol. XXI., No. 5, October, 1909.)

Investigation of horticulture was the main topic of consideration at the recent meeting of the Society of Horticultural Science. The need of it was the keynote of the meeting, and there was frank admission on the part of many that little more than a beginning has yet been made. It was made clear that in organisation for teaching and for experimentation horticulture has not kept pace with the advancement of the times, and that this fact has restricted its efficiency in both directions.

Horticulture as a separate subject was one of the first to be organised in the agricultural colleges. It was recognised as one of the grand divisions of agricultural education, and in point of equipment was developed quite as early as agriculture. It was popular, and the practical usefulness of its courses was realised early in the history of these instructions. It was looked upon as a department unto itself, and the distinctions between it and other departments of instruction were carefully guarded.

Horticultural instruction in this country has had a higher aim than that in Europe. The English and continental gardeners are largely men of the apprentice-school type, whose training has been centered on learning to do things—on developing skill and good judgment. The object of the agricultural colleges of this country is to make educated men, as well as men with practical training. The effort in horticulture has been to teach not only the art but the principles, so far as they are known, and to reduce horticulture to a pedagogic basis. But in this the subject has not kept pace with other branches of agriculture of late. The attempt to hold it intact and to itself has retarded the development of its organisation, and prevented its keeping pace with the differentiation and specialisation which have been going on in agriculture. The mode of organisation has now become traditional and unsuited to present conditions. The units are far too large, and do not develop specialisation either in teachers or students.

Horticulture is at present a highly developed art. The art has developed far beyond the understanding of the science, and skill drawn from experience is depended upon rather than a knowledge of principles. The work of horticulturists has dealt largely with the art—with the commercial and æsthetic side of the subject. This has predominated to such a degree as often, and perhaps usually, to give the student an imperfect conception of the field and a biased view as to the needs on the experimental side.

At no stage has there been the attempt to correlate horticultural practice and problems with the sciences that there has been in some branches of agriculture proper. The fundamentals of horticulture have not been sufficiently developed to meet the demands of scientific training, and graduate work in that subject has not been so

arranged as to promote investigation except in a quite limited way.

The science has been to a large degree borrowed from the related sciences, and systematic investigation in the science of horticulture by horticulturists has been prosecuted only sparingly. They have been too busy with the practical questions and often in conducting large plantations on a commercial basis. In their teaching and their experimental work they have spread themselves over too broad a field. Their work has been diffuse, and there have been few who have been content to confine themselves to a definite field. This has necessarily made much of the work superficial; and the success met with in assisting practical men has tended to engender a certain satisfaction with that kind of work, and prevented full realisation of the need of more fundamental investigation.

Horticulture as a science has not yet been organised, and the field of horticultural investigation has not yet been surveyed and mapped. Only quite recently has much consideration been given to the science of horticulture and its upbuilding. It presents a virgin field.

The meeting of the society at St. Cathrines, Ontario, was therefore a noteworthy one in the prominence given to this subject. In this respect it was a realisation of what was expected when the society was organised under its present name several years ago. As a mark of its interest in the subject, the society rejected a proposition to change its name to that of an Association of Official Horticulturists; the sentiment prevailed that the body should prevail the name and the character of a society of science as related to horticulture. As such it has a wholly unoccupied field, and may become a very important agency for the advancement of horticultural science and the reorganization of horticulture in the agricultural colleges and experiment stations.

In the presidential address, Mr. W. A. Taylor, of this Department, voiced the great and increasing need for science in horticulture. This must be developed out of thorough-going research, fundamental in character and method, and aimed primarily at principles and laws rather than at practical rules. The need of well-trained, well-poised men to conduct such work was strongly emphasized, for it was recognised, that without men with the proper training and the proper outlook, little real advancement in horticultural science can be looked for. Men first, and then the development of methods of research in horticulture, were looked upon as the two things most needful for horticultural investigation.

In a paper on the Adam's Fund in its relation to Investigation in Horticulture, E. W. Allen, of this Office, described the work which is being done in horticulture under that fund, and pointed out some of the essential features of investigation. The review showed that the Adams fund has stimulated a considerable amount of investigation in the field of horticulture, and that this covers a quite wide range. Of the forty-five projects in the field, however, only a part are being conducted by horticulturists, the remainder being in charge of men in other departments.

This illustrates the intimate relationship between horticulture and the basic sciences, and the necessity of taking account of the investigation done there in determining the present status of science in horticulture. The horticulturist entering the field of investigation requires a quite broad view of science. This familiarity must teach him the field of these sciences, and in a general way what has already been done. He must know not only the methods and the spirit of science, but he must be able to think clearly in science. He must be able to analyse the large practical problems in his subject, and resolve them into their scientific aspects, so as to define his investigation, get a point of attack, and give the work direction.

There is much advantage to be gained from the point of view of the horticulturist, provided there is combined with it a broad scientific outlook and sympathy. The man with practical sympathies and an understanding of the conditions of the art should be in position to turn out more efficient and useful investigation in horticulture than one whose duties take no account of these considerations.

But the horticulturists too often approach their problem from the standpoint of the art primarily, rather than that of science, and as a result the experimental work in that field has consisted quite largely of trials and experiments which gave only a superficial answer and are not conclusive or permanent in character. Up to the present time there has not been a very widespread or well-defined sentiment for research under existing conditions. The horticulturists have felt the pressure to get results of immediate practical application by the shortest route. The

needs of the art have appealed to them strongly, and the commercial and practical aspects of the subject have been alluring and fascinating.

In a general way there has been agreement among horticulturists that there ought to be more investigation in their subject, and a recognition that it is based on the application of principles in science which ought to be worked out. The demands upon them prevented such work in the earlier stages, and this has gradually shaped their attitude toward experimentation in horticulture until, in a way, it has become fixed, so that although the way now opens for research they are not drawn to it. They have not had the inspiration by investigation by foreign horticulturists, or an organisation of the field, or a summing up of the status of knowledge from a scientific standpoint.

Twenty years of experiment station work has changed the view but little. The work has been mostly in circles and has continued largely along beaten paths. Investigation is largely a matter of sympathies and temperament, and these have not been developed. The call is loud and insistent for men of that training, but the demand cannot be met. The difficulty gets back to the colleges. They are not holding up the ideals to the occasional student suited to that sort of career, and developing in him the standards for real progressive work in horticulture, the spirit of research, and the point of view of science as well as of commercialism. Until this is done, until horticultural instruction is put upon a higher plane, and the possibilities for advanced work in science with a horticultural outlook are developed, we shall have to draw largely on the basic sciences for the principles of horticulture.

More attention needs to be paid to what the basic sciences are contributing which has a bearing on horticulture, and it would be a great help to have the scientific basis of horticulture gathered from all sources and arranged in a systematic way. The knowledge of what has been done is a prerequisite to original investigation in any line.

It is a singular fact that we have no text-book or treatise on horticulture in its scientific aspects, no book which brings together for the teacher or the student what is really known of the principles which underlie operations in horticulture. We have such books for animal nutrition, for breeding, for agricultural chemisty, for soils, and other branches of agriculture, but not for horticulture. We have, it is true, books on the principles of fruit culture and of vegetable growing and the like, but they are the principles or elements of practice, not of science.

What a help such a book would be to both the teacher and the investigator! It would give the status of science in horticulture in such a way as to furnish a starting point for original and productive investigation, and something to build unto. There would be no further excuse for working around in circles. Such a treatise would illustrate the meaning of investigation, and open up a vast number of subjects for study. It would help greatly in organising the subject, and aid in formulating the practical problems in their scientific aspects.

The preparation of such a manual would prepare the way for a classification of horticulture from a scientific standpoint. It would furnish a basis for horticultural science, and would in fact be the beginning of that science. Science as applied to any subject is knowledge verified and arranged in an orderly system, and the office of science is the study of the sequence of phenomena. This, then, is the office of horticultural science—to bring together scientific knowledge as it relates to that subject and arrange it in an orderly system, and to study the sequence of phenomena in horticulture.

The paper by Prof. L. H. Bailey, on "The Field of Research in Horticulture," was a definition of the kind of work needed to develop the fundamentals of horticulture, the kind of men required to carry on such work, and the need for recognition. It was a frank setting forth of the manner in which horticulture as a subject is lagging behind, both in teaching and investigation.

Professor Bailey explained that the practices of the present day have grown up in a sort of haphazard and indefinite way. They are in large measure founded on shrewd guesses. Because they have served us very well so far there is no reason to expect them to continue to meet our needs. "Research in horticulture is as much to be furthered as is research in anything else . . . There really can be no worthwhile horticulture unless it be founded on original scientific investigation."

The definition given of research was clear and explicit. It was characterised as "a competent effort by a competent person to discover principles and facts that are underlying in one year as well as in another, and that do not grow old and out of date, in distinction from the making of tests and

the re-elaboration of present knowledge." Citing an illustration from horticulture of this distinction he said: "To determine what varieties of apricots are best adapted to a region may be one of the most useful undertakings, but it is of temporary value and a new test should be made every five or ten years. To describe the varieties of apricots is of the same order. If, however, one were to inquire for the principles that control the variation of apricots, or that determine the limitations of varieties, or that underlie the physiological processes in apricot growing, or that explain the close inter-relation of the apricot flora with climate, he would be entering the field of real research."

Research depends on the intention and method of the work, and specially on the capacity of the man who undertakes it. Its intention is to go to the bottom. It requires a research type of mind; "few persons are capable of projecting and completing real investigational work," hence men must be selected who have the special aptitude and qualification for it. It is futile to attempt to exact it of all men.

Professor Bailey expressed the belief that on the research side the horticulturists in the colleges and stations are not making great headway, and that few new men are being turned out who promise to meet the coming problems. The reason for this condition was assigned very largely to improper or inefficient organization and plan. "Horticulturists are forced to cover too much ground," he said "and necessarily they cover some of it very thin. The work is not sufficiently specialised. There is the same need that horticulturists become particularists as that other college officers become unquestioned authorities in particular subjects. . . . If the subjects that we class with horticulture had been wholly unrecognised until this time, it is inconceivable that they would now be organised under the present form."

He urged differentiation in function and specialization in horticulture, and pointed out that the horticulturists should themselves be actively preparing a reconstructive movement.

In regard to the kind of men needed for the college and station work, Professor Bailey laid great stress on the development of the point of view and the scientific spirit, and upon the necessity for graduate work. In this he drew upon his address given before the Association of American Agricultural Colleges and Experiments Stations, at Portland, the past summer. He urged that the colleges must not only train farmers but must train the trainers of farmers; they thus have a double work to perform.

"The college that makes no adequate distinction between these two lines of service ought not to undertake to train men for the best leadership, or to expect that even the best men from the graduating classes will be fitted for it."

The point was made that the college that trains a man inoculates the spirit into him. "No person is prepared for college and station work who does not possess the scientific spirit. . . . . . The point of view is the first consideration; the curriculum is one of the means of working it out." The type of mind determines the man's attitude toward a problem. "The attitude of the young man toward his work is just as important as the work itself; and for this attitude his instructors are in large degree responsible.

"Because a man has graduated from a college of agriculture it does not follow that he is fitted for a position in a college of agriculture. My contention is that we have now come to the time when we must more closely scrutinize the men who are to officer our colleges of agriculture and our experiment stations. We have now skimmed the surface in agricultural investigation, taking off the apparent and the easy subjects. The constituency is rapidly rising in intelligent appreciation of what we do. We must now go deeper, attack the essential underlying problems, teach more fundamentally."

Professor Bailey urged strongly the importance of postgraduate study; to prepare men for service in the colleges and stations. Such study he considered essential to efficient service at the present stage. He pointed out that practically all the postgraduate students of to-day will be candidates for positions as teachers and experimenters. It is important, therefore, that only men suited to it be encouraged to enter upon such graduate work, and that we appreciate the value of the time element in training persons for college and station work. They should be allowed to mature and ripen.

These are important considerations. They are fundamental to progress. There has been no cessation in the demand for men for our colleges and stations. The supply has not kept pace with it, and men have been pressed into the service who were never intended for it. The demand is especially for men of advanced training, men ripened

by postgraduate study, and with a broad insight into science and its methods and its spirit.

This is true of horticulture as well as elsewhere, but the supply is exceedingly small. The opportunity is here but not the men to meet it. The need for investigation lies in its relations to both the art and to teaching. The more transitory tests and experiments have been extremely useful, although half-way knowledge is uncertain and likely to be misleading. Horticulture is largely intensive, and mistakes are serious. As Prof. Bailey said, "A special obligation of good and careful investigation rests on all those who study any of the practices whereby men and women wrest their livelihood in the world." From the standpoint of the teacher the present need for investigation is even more imperative if horticultural instruction is to keep pace pedagogically with that in other branches of agriculture, based on investigation in which the horticulturists themselves take an active part.

There has seemed sometimes to be a disinclination among horticulturists to map out a restricted field and settle down to investigation in it. In a number of instances men are now employed primarily for investigation, and the attempt is made to relieve them of every disturbing or distracting feature, and to leave them to their quest. Some of these men unfortunately fail to meet the requirements, because they cannot resist the fascination of horticulture as an art and a business, and the practical questions which it suggests.

The commercial possibilities are disconcerting to some well-prepared men. Too often they are drawn by the attraction of making money, rather than by that of adding new facts to the fund of human knowledge and thus becoming one of the civilising agencies of their day. The commercial spirit dominates the scientific, and they become restless and dissatisfied. We can never have investigation in horticulture under the direction of horticulturists, until we have a class of men with the investigative turn of mind, the training which prepares for it, and the taste which makes its pursuit and its associations satisfying.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT XLIX.

Membership.—Since the meeting of February 7, 1910, the following members have joined the Society:—Chas. A. Peiris, D. E. H. Pedris, W. M. R. Elwes, T. McGuffie, Henry B. Less, J. W. Oldfield, Geo. Boysen, W. Carver, T. Felix Fernando, S. Alex. Marten, Watkin R. Roberts, A. J. Van Rooyen. These additions bring up the total membership to 920.

Official Tours.—The Organizing Vice-President (Dr. Willis) returned to Ceylon after nearly a year's absence on leave and resumed duties on the 1st instant, relieving Mr. R. H. Lock, who had been acting for him.

On the 20th and 21st Dr. Willis visited the Matale District in connection with the extension of school garden work at Madipola, where an addition of land has been granted.

The Secretary has been on inspection duty to Alutgama, Kosgama, Weke, Ambanpola, Galgamuwa, and Matale.

Mr. Wickramaratne visited Maggona, Chilaw, Puttalam, and Bellana, and has been engaged practically during the whole of March in the Rayigam korale, being assisted during the latter part of the month by Mr. N. M. Jayasuriya, *locum tenens* for Mr. L. A. D. Silva, who is on sick leave.

Mr. Molegode has been working in the Matale District, visiting Naula, Dambulla, Inamaluwa, Galawella, &c.

Mr. Chelliah, whose work lies in the Northern Province, paid a visit to Anuradhapura in connection with damage done by the paddy fly. He has since left (4th instant) for Batticaloa to temporarily fill the vacancy created by the transfer of Mr. Breckenridge to the scene of the tobacco experiment at Maha Illuppallama.

Branch Societies.—The Secretary of the Dumbara Branch has forwarded report and balance sheet for the past year, which will receive due notice in the Society's annual report. The branch, which continues to do excellent work, has arranged for an agricultural show to be held at Teldeniya on July 22 and 23. Special medals will be offered (1) for the best exhibit of Tobacco grown and cured in the district, and (2) for the best sample of locally raised Cotton.

The programme of the Harispattu Branch for 1910 includes paddy cultivation on improved lines at five centres under the supervision of the Agricultural Instructor of the Central Province. A village show has also been decided on.

The Galle-Gangaboda Pattu Branch is carrying out a comparative test to ascertain the difference in the yield of broadcasted and transplanted paddy. This Society is interesting itself in assisting cultivators to secure manure from a

reliable source, instead of purchasing adulterated stuff from the local bazaar. A market garden is also about to be started at Baddegama.

The Secretary of the Anuradhapura Branch reports that a series of ploughing demonstrations is in contemplation if the present drought is relieved in April; also that a show is under consideration.

The Rayigam Korale Branch holds market shows at Kalutara, Wewita, and Bellana on May 7, 14, and 21 respectively. The Wewita show will be held in the Society's experimental garden near Bandaragama. Prizes will be awarded to the best school gardens in the district.

Paddy (*Rice*).—The Galle-Gangaboda Pattu Branch approached the Society with a view to repeating a previously successful effort at co-operation for the supply of manure for yala cultivation. Satisfactory arrangements have been made for a supply of crushed bones, which is the manure commonly used in the South.

Mr. W. R. Bibile, Ratemahatmaya, at whose request a small quantity of the well-known Samudrabali paddy was obtained from India, reports that a trial of this variety by Mr. D. Kotalawala yielded seventy times the quantity sown. The seed was put in the nursery on August 13 last, transplanted on September 6, and the crop harvested on December 23. The land was manured with cattle dung. Agricultural Instructor Wickremaratne reporting on this experiment says; "I saw the field in November and found the transplanting had been done too close, otherwise the yield would have been considerably greater. The large size of the ears was striking."

Mr. J. A Wirasinghe, Mudaliyar of the Rayigam korale, who supervised a series of experiments by his headmen with a view to proving the advantages of transplanting, reports that the results were very satisfactory. The actual figures will be given in the next Progress Report.

Mr. Valoopillay of Anuradhapura reports that a variety of paddy, known in Tamil as "Thillanagakam," was able to withstand the attack of the paddy fly, while two or three other varieties sown at the same time were seriously damaged. A sample of the paddy has been secured, and the matter is being further investigated with a view to discovering the possible cause of immunity and the existence of other varieties possessing similar properties.

Cotton.—The following is a report by Messrs. D. J. Ross & Co. on a sample of cotton grown in the Province of Uva: "Mr. H. E. D'Esterre of Braemore has asked us to write you with reference to the cotton sent to us from Randeniya. To begin with, we understand this cotton was grown from Caravonica seed. Last September we got a small quantity of this seed cotton from Mr. D'Esterre and had it ginned in India by writer's brother. The ginned sample we sent to our friends in Europe, who gave a very favourable report on the cotton, and their valuation, dated Manchester, September 29, was 9*d*. to 9½*d*. per lb. This will give you a better idea than anything of the quality. Of course, the lot we have received from Mr. D'Esterre may not have been so well ginned as the sample we got, as he and his people have little knowledge of ginning, and it is the easiest thing in the world to destroy cotton in ginning and reduce the value by half or more. The staple of this cotton is of fair length and good strength, but is what is known amongst spinners as rough staple."

The Assistant Government Agent of Hambantota is conducting a cotton growing experiment in the Tissamaharama district.

The Secretary, Wanni Hatpattu Branch Society, in reply to an inquiry, states that in 1909 some 33 cwt. of cotton were produced in his district, 31 cwt. of which was raised by a European planter, and about 2 cwt. on Crown chenas by villagers.

According to the report of the Secretary of the Jaffna Branch 260 acres of cotton were planted in Delft last year.

The British Cotton Growers' Association advise the despatch of half a ton of Black Rattler and 25 lb. each of Allen's improved Sunflower and Griffin cotton seed. Black Rattler was specially recommended for trial in Ceylon by Professor Dunstan. Intending growers should book early for this seed.

I regret to have to record the death of Mr. Cobham-Lea, one of the pioneers of cotton cultivation in the North-Central Province, who had been growing Sea Island cotton near Galgamuwa under great difficulties and with indomitable pluck.

Implements and Appliances.—The popularizing of light iron ploughs (such as the Meston) suitable to local conditions has occupied the attention of the Agricultural Instructors. The services of Mr. Wickramaratne were placed at the disposal of the Assistant Government Agent, Kalutara (Mr. Plant), for the

greater part of a month to carry out a programme of work for the cultivators of that district. The Assistant Government Agent was himself present at some of the centres where demonstrations were held, and as a result of the personal interest he showed in the work, there has been considerable activity and enthusiasm in the localities visited by the Instructor.

Mr. Molegode held several ploughing demonstrations in the Matale District, but owing to the very dry season, coupled with the indifference of the headmen, the results were not very satisfactory.

A Sivagiri plough has been forwarded to Mr. Chelliah for use in the Northern Province, and a duplicate set of the implements received from the Koilpati Farm will follow. Mr. Chelliah is about to begin a series of ploughing demonstrations in the Eastern Province with the approval of the Government Agent, and has also furnished himself with one of Mr. Lefroy's bags for capturing paddy flies, so that he may be in a position to go to the assistance of cultivators whose crops are being damaged by this pest. Mr. Valoopillay, referring to Mr. Chelliah's demonstration in the working of the bag at Anuradhapura, writes: "I am of opinion that this treatment will be effective and shall give it a good trial when the plague comes on again, probably in March, and report results."

The difficulty in threshing paddy experienced after the recent outbreak of rinderpest in the south and east of the Island pointed to the necessity of some suitable appliance for this purpose being introduced to the notice of cultivators. A local firm has imported two machines of moderate price, one for hand work and the other for bullock power, which appear likely to suit local requirements. These have already had a private trial, and it is intended to shortly give members of the Society an opportunity of seeing them worked. On its capacity being tested the hand machine proved that it could do more than twice as much with the same number of hands required to control seven animals. The machine adapted for a pair of bullocks or buffaloes promises still greater possibilities.

Orchella Weed (Rocella Montagnei).—In November, 1908, attention was directed to this lichen in a letter from Professor Dunstan, Director of the Imperial Institute, London, to the Hon. the Colonial Secretary, in which it was stated that there was a considerable shortage of the product in the English market, and in consequence manufacturers were unable to obtain supplies. It was added that consignments of good quality were likely to fetch £12 per ton and over c.i.f. London, and the hope expressed that it would be possible to revive the trade in the dye stuff, which at one time was a large export from Ceylon. A copy of this letter having been transmitted to the Society by the Secretary of the Ceylon Planters' Association, inquiries were set on foot, and after a good deal of correspondence, an order for 5 tons at the price quoted above was placed by a London firm, acting through the Imperial Institute, with Mr. M. C. Abdul Cader of Jaffna. A consignment consisting of 96 bags was duly despatched through the Society at the end of last year. The actual weight of the orchella weed was 87 cwt., the shortage being due to a miscalculation discovered at the last moment when there was no time to make up the deficiency. For the information of interested parties the details of the transaction are given below:—

	Cwt.	qr.	lb.
Ninety-six bags of orchella weed, gross weight ...	90	2	7
Less tare and draft ...	3	1	20
	87	0	15

	£ s. d.	£ s. d.
At £12 per cwt. ...	52 5 7	
Less discount ...	1 6 2	
		50 19 5
		Rs. c.
At 1s. 4 3/16*d*. ...	—	755 70
Cost of boat hire from Jaffna ...	72 0	
Freight to London, Rs. 137·98; shipping charges Rs. 43·84 ...	181 82	
		253 82
		501 88

This amount (Rs. 501·88) was duly remitted to Mr. Cader, who, however, reports that he is not satisfied with the results of the transaction.

Sericulture.—A further communication has come from Europe with reference to Eri cocoons, embodying definite proposals of a business-like nature. Any member interested in this matter could get information regarding the proposal on applying to the Secretary.

The Society has now secured a cocoon cleaning and a spinning apparatus, and is about to entrust them to the teacher of Mediwake school, who has shown special aptitude for working such machines.

The Indian Imperial Entomologist has kindly forwarded samples of machine-cleaned Eri cocoons (yielding 100 per cent. silk) and spun silk for inspection.

Seeds and Plants.—An order has just gone forward for over 3,500 packets of vegetable seeds booked by members for the May-June planting.

Two bushels of the 60-days Samba have been received for Mr. R. C. Proctor of Chilaw, and a bushel of the drought-resistant paddy, known in Burmese as "Taung-deik-pan," for the Assistant Government Agent of Hambantota (Mr. Woolf).

Some seed of the Algaroba or Mesquit bean (*Prosopis juliflora*) has been received from the Hawaii Islands, but it is doutful whether any will germinate, as they have been badly attacked by insects. The seeds were got out at the instance of a member, who thinks that the tree might be introduced into our dry areas and meet the difficulty of securing a supply of cattle fodder during the rainless months of the year. Colombo is apparently too wet both for the Algaroba and the Locust bean. Plants of the latter have been forwarded to the drier districts for trial.

A good quantity of Lima beans of the best kinds has now been distributed, and should help to improve the quality of the beans usually found in our markets.

Six bags of Congayam grass seed (*Pennisetum cenchroides*) are expected within the next few days for planting in our dry areas. A plot of it growing at the Government Stock Garden has made a surprising stand against the recent drought, and so far the grass gives no signs of spreading as a weed.

The attention of members is invited to the special advertisement in the "Tropical Agriculturist and Magazine of the Ceylon Agricultural Society" for March, in which a list of the seeds and plants still available to members at the Government Stock Garden is published.

Reports and Analyses.—The Government Agricultural Chemist has reported as follows on two samples of soils from Maggona Reformatory where garden work is being carried on:—

Sample No. 1 is a brown cabooky loam in a poor state of division. The soil has no body, and to give it this necessary quality and binding material it would be as well to take several crops of green manure off it and mulch in the leafy material. The mineral plant food is very poor in phosphoric acid, which would be a disadvantage if grain crops are to be grown, and would require to be replenished with a readily available form of phosphoric acid. The potash, although not so poor as the phosphoric acid, is poorer than it ought to be to yield good crops. The lime and magnesia are in fair proportion.

Sample No. 2 is similar in appearance to No. 1. In mechanical and chemical composition there is but slight difference, but the potash and phosphoric acid are in better proportion. As a general mixture the following might be recommended:—

Mixture.	lb.	Nitrogen.	P_2O_5	K_2O
Fish	...300	15·0	12·0	—
Castor Cake	...300	15·0	—	—
Steamed Bone Meal	...100	3·5	23·0	—
Concentrated Super	... 50	--	21·0	—
Nitrate of Potash	... 50	5·5	—	19·0
Sulphate of Potash	... 50	—	—	25·0
Per Acre	...850	39·0	56·0	44·0

As much mulch, such as cattle manure, prunings, refuse, &c., should be spread on the land to improve the tilth.

The Government Entomologist furnishes the following report on a sample of Anuradhapura oranges damaged by insects:—"The oranges submitted have been attacked by the fruit fly (*Dacus* sp.). The most practical treatment for this pest is to collect and destroy all fallen and wormy fruit daily. The fruit may be destroyed either by burning, or by sinking it in water, or by burying it deeply. In the latter case, at least one foot of firmly pressed earth must cover the fruit, or the flies will make their escape. It is particularly important that this treatment should be adopted during both crops of fruits, although very little damage may be noticeable at the time. It is also possible to do some good by poisoning the adult flies. This may be done by spraying the trees with a mixture of syrup (sugar and water) and arsenic, to which a few drops of citronella oil have been added. If your correspondent would like to try this method, I can give detailed particulars of the poison mixture."

The Government Entomologist replies as follows to a correspondent inquiring about a wash to keep off the paddy bug:—"I fear that there is no chemical solution that can be relied on to keep off the paddy bugs. Recommendation No. 3 of the Circular is the nearest approach to such treatment, and of the three substances recommended, I should prefer kerosene. The systematic collection of the bugs—either by the sticky

winnow or by the use of a cloth bag—will be found an important measure in the treatment. But I consider that preventive measures are still more important than curative treatment. I have several times pointed out that, in the intervals of the rice crops, the bug feeds upon and breeds on the natural grasses that spring up on the banks and on waste lands surrounding the fields. This grass should be periodically burnt off. By so doing the virulence of the pest during crop time will be very greatly diminished. Grass growing in fallow fields should not be allowed to run to seed. It must be understood that it is upon the unripe seed of the grasses that the bugs feed. The fire should therefore be applied before the grass has ripened its seed and dried up. Clean cultivation and rotation of crops would be a very great check upon the excessive development of the pest."

The Director of the Imperial Institute, refering to a sample of *Gardenia latifolia* resin forwarded for investigation, writes that, as the resin does not appear to belong to any well-known groups of resins, a detailed chemical examination is being made, which will take some time.

Miscellaneous.—The Agricultural Explorer attached to the United States Department of Agriculture, in asking for assistance in securing some thousands of mango seeds, writes :—"Through the introduction by this office of the best East Indian mangoes, of which we have distributed many plants in the West Indies and Florida, very unusual interest has been aroused in this fruit. Although we have imported a large number of varieties as grafted plants, it is our belief that promising new varieties could doubtless be orginated from these if we planted several thousand seeds of the different recognized good varieties from various Oriental countries." The directions given for packing may be useful to others, and are given below :—"Select only seeds which have not been ruined by having a fork stuck into them. Scrub the flesh off as thoroughly as possible with a stiff brush and abundance of water. Dry the seeds for an hour or so in the shade (under no circumstances expose them to bright sunlight after washing), then spread in layers in the packing material in a box that will not be broken in the mail. To prepare the packing material, take equal parts by volume of finely powdered charcoal and chopped sphagnum moss. Charcoal from which all creosote has been expelled will be sent to you when we order the seeds. It is very important that the packing material be of the right dampness—neither too wet nor too dry. In order to get the mixture in the right condition, throw the sphagnum into a pail of water and stir it until thoroughly saturated with the water. Then take it out by the handful and wring it as hard as possible, squeezing out every drop of water possible with the hands. Mix this damp sphagnum with the charcoal, and use this mixture in layers between the layers of mango seeds."

The Superintendent of School Gardens reports that school gardening is spreading to the girls' schools. The teacher of the Balangoda Girls' School has written acknowledging her indebtedness to the "Govikam Sangarawa" (the Sinhalese Agricultural Magazine) for the instruction she has derived from that publication, and states that the produce of her garden is worth Rs. 50 per mensem to her.

It is much to be regretted that the magazine referred to above has not a larger circulation, as it is greatly appreciated by all into whose hands it falls. The Committee on publications might well consider whether it would not be to the advantage of the Society to vote a sufficient sum to allow of, say, 1,000 copies being supplied to each Government Agent of the Sinhalese-speaking Provinces, for free distribution, at the discretion of the Mudaliyars and Ratemahatmayas, so that the Magazine may have as wide a circulation as possible.

The visit of Professor Dunstan of the Imperial Institute, who evinced great interest in the work and possibilities of the Society, is worthy of record. The study he has made of the conditions under which cultivation is being carried on in Ceylon will, no doubt, enable him to offer valuable advice to members of the Society. The Secretary will be glad to receive any specimens upon which reports are required, and to forward them to the Imperial Institute for investigation.

A set of coloured plates of insect pests, with short descriptions and directions, has been received from the Imperial Entomologist for India. These plates are full of instruction, and are particularly valuable for educational purposes.

C. DRIEBERG,

Secretary.

Colombo, April 6, 1910.

Correspondence.

PACKING PLANTS FOR EXPORT.

DEAR SIR,—Most of your readers would appreciate an article by Mr. Macmillan on "*Packing Para Rubber Plants for export.*"

One always hears of plants sent out by the Gardens arriving in excellent condition after a long voyage.

The articles which have from time to time appeared on packing Para seeds for export were invaluable to many readers.

Yours faithfully,
A. VAN STARREX.

Crystal Hill Estate,
Matale, 26th April, 1910.

[Mr. Macmillan states that he has not much new to add to what he has already written; his forthcoming book on Gardening in Ceylon will contain a chapter on this subject.—EDITOR.]

COTTON SEED RATE FOR PLANTING.

SIR,—In the January number of the *Tropical Agriculturist* there is a report on a tour made by the Secretary of the Ceylon Agricultural Department to India.

On page 66 of the *T. A.* the Secretary says:—Authorities do not seem to agree as to the seed rate for cotton. The West Indian Department advises 6 lbs. for Sea Island, myself 48 lbs. for Egyptian, and at Koilpati 10 lbs. is considered ample.

I should like in the first place to point out that 45 lbs. was recommended, and not 48 lbs.

As there seems to be a lack of information on this question, I would like to explain to your readers some of the reasons for those differences in amounts recommended.

It is considered that quantity of seed required depends on the following factors:—

1. The distance between the lines or ridges and number of seeds sown at each hole.
2. The character of the soil.
3. The size of the seed.
4. The conditions under which the crop is grown (*i.e.*, irrigation or rain).

In the Sea Islands the distance is at least 5 feet between ridges and 22 inches between plants, the soil is light alluvium, and therefore the percentage germination is high and little resowing required, single plants only are left.

Cotton under irrigation in Egypt is planted 32 to 34 inches between ridges and 19 to 20 inches between plants; the soil is frequently heavy and germination often irregular; resowing in places is practically always required; the quantity of seed used in Egypt is 1¼ bushels per acre.

With Indian cottons less seed is required as the seed is generally much smaller than Egyptian or Sea Island.

It has been my experience that cotton under irrigation always requires more seed than cotton grown with rain; the irrigating seems to cake the surface soil, and unless there are several seeds together they are unable to break through.

In Nyasaland, without irrigation I find that 10 to 12 lbs. is sufficient for Egyptian and as low as 6 lbs. for Upland cotton.

In conclusion, I consider it a mistake to economise in seed, especially with cotton grown under irrigation.

I am, etc.,
J. STEWART J. MCCALL,
Director of Agriculture for Nyasaland.

The Agricultural & Forestry Department,
Zomba, Nyasaland Protectorate,
4th March, 1910.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 12th April 1910.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	80s a 85s
Zanzibar & Hepatic ,,	Common to good ..	40s a 70s
ARROWROOT (Natal) lb.	Fair to fine ..	7d a 8d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ...	£6 15s a £6 17s 6d
Bombay bleached ,,	Fair to good	£7 10s a £7 12s 6d
,, unbleached ,,	Dark to good genuine ..	£5 15s a £6 10s
Madagascar ,,	Dark to good palish	£6 15s a £7
CAMPHOR, Japan ,,	Refined	1s 5¾d a 1s 7d
China ,,	Fair average quality ...	140s
CARDAMOMS, Tuticorin	Good to fine bold	2s a 2s 5d
	Middling lean	1s 9d a 1s 10d
Tellicherry	Good to fine bold ..	2s a 2s 3d
	Brownish ..	1s 3s a 1s 9d
Mangalore ,,	Med brown to fair bold	1s 10d a 2s 8d
Ceylon. - Mysore ,,	Small fair to fine plump	1s 4d a 2s 10d
Malabar ..	Fair to good ...	1s 2d a 1s 4d
Seeds, E. I. & Ceylon ,,	Fair to good ..	1s 8d a 1s 9d
Ceylon Long Wild ,,	Shelly to good ..	6d a 1s 7d
CASTOR OIL, Calcutta ,,	Good 2nds ..	3⅛d a 3 1-16d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	40s a 45s
CINCHONA BARK.—lb.		
Ceylon	Crown, Renewed	3⅜d a 7d
	Org. Stem	2d a 6d
	Red Org. Stem	1¼d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts	Good to fine quill	6½d a 1s 5d
per lb. 2nds	,, ,,	5¾d a 1s 4d
3rds	,, ,,	5d a 1s
4ths	,, ,,	4½d a 8½d
Chips, &c..	Fair to fine bold	2¼d a 3d
CLOVES, Penang lb.	Dull to fine bright pkd.	1d 5s a 1s 6d
Amboyna ..	Dull to fine	9d a 10d
Ceylon ..	,, ,,	9d a 10d
Zanzibar	Fair and fine bright	5¼d a 5½d
Stems ..	Fair	2¼d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	65d a 100s
Native	Good ordinary	nominal
Liberian ,,	Fair to bold	43s a 55s
COCOA, Ceylon Plant. ,,	Special Marks	60s a 69s
	Red to good	54s a 59d
Native Estate ,,	Ordinary to red	39s a 56s
Java and Celebes ,,	Small to good red	30s a 80s
COLOMBO ROOT ,,	Middling to good	30s a 35s
CROTON SEEDS, sift. cwt.	Dull to fair	45s a 47s 6d
CUBEBS ,, ,,	Ord. stalky to good	150s a 170s
GINGER, Bengal, rough ,,	Fair	40s nom.
Calicut, Cut A ,,	Small to fine bold	65s a 85s
B & C ,,	Small and medium	55s a 60s
Cochin Rough ,,	Common to fine bold	45s a 60s
	Small and D's	42s 6d a 45s
Japan ,,	Unsplit	43s
GUM AMMONIACUM ,,	Sm. blocky to fair clean	35s a 73s 6d
ANIMI, Zanzibar	Pale and amber, str. srts.	£15 a £16
	,, ,, little red	£12 a £14
	Bean and Pea size ditto	75s a £14 2s 6d
	Fair to good red sorts	£8 a £12
	Med. & bold glassy sorts	£6 a £8
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d nom.
Turkey sorts ,,		30s a 60s
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom.
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£9 a £10 10s
	com. stony to good block	15s a £8
KINO	Fair to fine bright	6d a 9d
MYRRH, Aden sorts cwt	Middling to good	55s a 65s
Somali ,,	,, ,,	50s a 55s
OLIBANUM, drop ,,	Good to fine white	45s a 50s
	Middling to fair	30s a 40s
pickings ,,	Low to good pale	10s a 22s 6d
siftings ,,	Slightly foul to fine	13s a 16s
INDIA RUBBER lb.	Fine Para bis. & sheets	12s 4d
	,, Ceara ,, ,,	11s
Ceylon, Straits,	Crepe ordinary to fine..	12s 2d a 12s 6d
Malay Straits, etc.	Fine Block ..	12s 6d
	Scrap fair to fine ..	9s 6d a 10s 2d
Assam	Plantation ..	5s 6d a 8s
	Fair II to ord. red No. 1	6s a 7d
Rangoon	,, ,,	4s 6d a 5s 3d

	QUALITY.	QUOTATIONS
INDIARUBBER. (*Contd.*)		
Borneo	Common to good	3s 7d a 4s 8d
Java	Good to fine red .	6s 3d a 7s
Penang	Low white to prime red	3s 9d a 4s 8d
Mozambique	Fair to fine red ball ...	7s 6d a 9s
	Sausage, fair to good ..	7s a 8s 10d
Nyassaland	Fair to fine ball ...	6s 3d a 7s 4d
Madagascar	Fr to fine pinky & white	5s 6d a 6s 6d
	Majunga & blk coated ..	4s a 4s 4d
	Niggers, low to good ..	2s a 5s
New Guinea	Ordinary to fine ball ..	4s 6d a 6s
INDIGO, E.I. Bengal	Shipping mid to gd violet	2s 10d a 3s 8d
	Consuming mid. to gd.	2s 6d a 2s 10d
	Ordinary to middling	2s 2d a 2s 5d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	1s 5d a 2s 4d
MACE, Bombay & Penang	Pale reddish to fine	1s 11d a 2s 4d
per lb.	Ordinary to fair	1s 8d a 1s 10d
Java	,, ,, good pale	1s 7d a 2s
Bombay	Wild	4d a 4½d
MYRABOLANES, cwt	UG and Coconada	5s a 5s 6d
Bombay ,,	Jubblepore	5s a 6s
	Bhimlies	5s 3d a 6s 6d
	Rhajpore, &c.	4s 9d a 5s 6d
Bengal ,,	Calcutta	5s 6d a 6s
NUTMEGS— lb.	64's to 57's	1s a 1s 6d
Bombay & Penang ,,	110's to 65's	4¾d a 1s
	160's to 115's	4d a 4½d
NUTS, ARECA cwt.	Ordinary to fair fresh	14s a 15s
NUX VOMICA, Cochin	Ordinary to good	9s a 11s 6d
per cwt. Bengal	,, ,,	6s 6d a 7s
Madras	,, ,,	6s 9d a 8s
OIL OF ANISEED ,,	Fair merchantable	4s 5d
CASSIA ,,	According to analysis	3s 4d a 3s 8d
LEMONGRASS ,,	Good flavour & colour	2¾d a 2⅞d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2d a 1s
CITRONELLE ,,	Bright & good flavour	1s
ORCHELLA WEED—cwt		
Ceylon ,,	Mid. to fine not woody...	8s a 10s
Madagascar ,,	Fair ...	10s
PEPPER – (Black) lb.		
Alleppy & Tellicherry	Fair ...	3⅞d
Ceylon	,, to fine bold heavy ..	3⅞d a 4⅛d
Singapore ...	,, ...	4d
Acheen & W. C. Penang	Dull to fine	3½d a 3¾d
(White) Singapore ,,	Fair to fine	6¾d a 8d
Siam ,,	Fair	6¾d
Penang ,,	Fair	6¼d
Muntok ,,	Fair	7⅛d
RHUBARB, Shenzi ..	Ordinary to good ...	1s 3d a 2s 8d
Canton ..	Ordinary to good ..	10¼d a 1s 1d
High Dried..	Fair to fine flat ..	10½s a 1s
	Dark to fair round ..	5d a 6½d
SAGO, Pearl, large ...	Dull to fine	20s a 22s
medium ..	,, ,,	17s 6d a 20s
small ...	,, ,,	17s. 6d a 18s 6 d
SEEDLAC cwt.	Ordinary to gd. soluble	45s a 60s
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	2¾d a 4¼d
	Commonspeckyand small	1½d a 2¼d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ..	27s a 135s
Bombay ,,	,, ..	18s a 127/6nom.
Mergui ,,	,, ,, ...	£8 5s a £9 7s 6d
Manilla ,,	Fair to good ..	£7 10s a £10 15s
Banda ,,	Sorts	25s a 30s nom.
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	11s a 12s 6d
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	11s a 29s
	Pickings ..	8s a 23s
TURMERIC, Bengal cwt.	Fair ..	19s 6d
Madras ,,	Finger fair to fine bold	23s a 24s 6d
Do. ,,	Bulbs [bright	17s a 18s
Cochin ,,	Finger ..	20s
	Bulbs ...	14s 6d
VANILLOES— lb.		
Mauritius ... } 1sts	Gd crystallized 3½ a 8½ in	13s a 18s
Madagascar ... } 2nds	Foxy & reddish 3½ a ,,	11s 6s a 14s
Seychelles .. } 3rds	Lean and inferior ...	11s a 11s 6d
VERMILLION ..	Fine, pure, bright .	3s 2d
WAX, Japan, squares	Good white hard ...	40s

THE SUPPLEMENT TO THE

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COMPILED AND EDITED BY A. M. & J. FERGUSON.

No. 5.] MAY, 1910. [VOL. VI.

RUBBER TAPPING UP TO DATE.

PRACTICAL NOTES.

(*Special.*)

At the request of several eminent Rubber Planters, I have been asked to give a description of how tapping knives should be used and how tapping may be most profitably carried out. I can only give a few

NOTES AFTER SEVEN YEARS' CLOSE STUDY

and practical experience gained

IN CEYLON, AND TWO YEARS SPENT IN THE STRAITS,

Johore, etc., where I stayed at intervals on most of the largest Rubber Estates.

After a Rubber tree has been properly marked out, to suit the method of tapping to be adopted, the following information may be found useful :—

1. In the first operation the knife which should be employed when tapping is commenced, is the "Leading" or "Vertical Channel" knife. This vertical channel should be very carefully made and great care should be exercised in the depth.

This channel should be cut close to the Cambium near the area to be tapped. This Vertical Leading Channel should be made to face the right direction. All Rubber Estates are, of course, or should be, lined East and West.

Where Rubber has been closely planted, it is immaterial which direction the channel faces. It is of the greatest importance that the knife used be provided with a special guard which can be regulated to a "nicety" and thus prevent damage to the tree—at the same time securing the very best results.

2. The second operation is the opening of the area to be tapped, after it has been carefully marked out. Even greater care (if possible) should be exercised in this delicate work.

If tapping on full or half "Herring Bone" System, this cut should be made at an angle of 35 to 45 degrees from the "Leading" channel, with the "V" or if with the "Y" method, (which I saw several years ago very successfully carried out on Lanadron Estate in Johore) a slightly more acute angle is used. The knife employed is known as the square-cut First Incision knife, and should be made with a properly constructed guard which can be adjusted, so that the knife will cut to any required depth and at the same time will not penetrate the Cambium. This knife should be about 1-16th of an inch broader than the side or guard of the paring or tapping knife to be subsequently employed. In cases where no up-to-date pull and push knife can be got, it will be found advantageous to cut a small tapping channel at the extreme top end, of about one inch in length in the opposite direction to the main, or each tapping channel. This enables a "tapper" to get a clean cut and besides saving the bark (or rather using it), assists to keep the tree symmetrical when the other side is tapped—the renewed bark on the previously excised portion will then have an even surface. I have seen very large numbers of trees put very much out of original shape through insufficient attention being given to these important, though apparently small matters.

I would here make a special note for those interested, that only specially trained coolies should be employed on these two operations as badly opened trees, especially young ones, practically mean the beginning and continuation of bad tapping. These two operations are now made easier and safer by using "Opening" knives with proper inflexible guards.

A trained cooly can easily open a hundred 5 to 6 year old trees in a day; and once open, the operation has not of course to be repeated for say 18 to 20 months, so the proportion of Opening-Tappers to the ordinary is very small indeed.

3. The third operation of paring or tapping is, of course, much easier, but care should be taken in the selection of knife to be used. This knife is known as the Tapping or Paring knife.

From the experience of many well informed Planters it has been found best and safest to employ a knife with a rigid guard having a slight "lead" or "feeler" with a rounded lip—this enables the Tapper to do the best work with least possible damage to the tree. When a good Tapper goes into the wood he feels it at once. A properly constructed tapping knife is not intended to cut wood, but only Cortex or living and dead bark. The edges should be as keen as a pen-knife or even a razor—the cleaner the cut, or shaving, the better the flow of latex ; a jagged cut with a blunt tool impedes the flow to a very appreciable extent.

The blades should be changeable, and if made with four cutting edges as a few are, they should also be made reversible. If a blade is made thin and keen like a razor and properly supported to withstand the work, it will give the very best results.

A tapper should not rub his knife back over the newly excised bark, but should make two or three clean cuts, as the contour of the channel will not allow the paring to be made in one operation. Rubbing backwards and forwards over a newly made paring, closes up many delicate latex cells which may have just only been slightly opened. It has generally been found in practice, that about 3/64ths-of-an-inch is quite sufficient paring to remove at one operation and the number of times a tree should be tapped, entirely depends on climatic conditions.

PRICKERS AND WOUND RESPONSE.

From observations carefully noted from the infancy of this very important Rubber industry in the East, I agree with many practical Planters, that tapping a Rubber tree is similar to trying to milk a cow ; the little that is left in the living source of supply remains there for its nourishment. A wound is caused which, in 99 cases out of 100, becomes a festering centre ; and after that, if it be not properly cared for, the ultimate result is what can only be expected by anyone who knows anything about Botany —the "protea" is disturbed for ever.

GEO. S. BROWN.

A CEYLON WEED: "TEPHROSIA PURPUREA."

April 19.

DEAR SIR,—The article on *Tephrosia purpurea* taken over from the *Agricultural News* of the West Indies and originally from *L' Agronomie Tropicale* into the March *T. A.* (p. 227) is rather misleading. The reference to the plant as one suitable for forming hedges and growing up to 9 and 11 feet will make those who are not familiar with this common weed think of it as a probable shade tree and protection against wind. The article speaks of its ability to combat lalang and keep down other weeds. Those who know the Sinhalese "pila" and Tamil 'kavalai" will realise how exaggerated are the claims made on behalf of the plant.—Yours truly,

D.

A BELGIAN RUBBER CO. DIRECTOR IN COLOMBO.

Among interesting foreign visitors to Ceylon recently was M. Jacob, a Director of a big Java Rubber Co., the Cultuur Maatschappij Bajabang, with 3,500 acres, of which some 1,400 are planted in rubber the oldest being four years old and of which 600 to 800 acres more are being planted up this year. Our visitor, who is also a member of the Belgian "Société des Planteurs de Caoutchouc" of Antwerp, was visiting several rubber estates in Ceylon, including Clyde, Kalutara, with an introduction from Mr. Davidson, and also saw all he could of the rubber trees at Peradeniya and at Heneratgoda. He is now on his way to Java to furnish a report on the Bajabang property for his co-directors and shareholders; and hopes to visit estates in the F. M. S. *en route*.

M. Jacob told us that the best four-year-old rubber on Bajabang is of some 23 inches girth, 3 feet from the ground, and that tapping is being commenced this year, The oldest rubber he knows in Java is on a neighbouring estate, 40 acres of 5-year-old and 200 of 4-year-old. Java growth as a rule is the same for 4-year-old as 5 or even 5½ in Ceylon, while there is not much to choose between it and that of rubber in the Malay States. The greatest amount of capital put into rubber in Java so far is Belgian, rather more than the amount of English and much more than that invested from Holland. The difficulties in obtaining land, he said, were certainly getting greater—in securing the best land, that is, most suitable for growing rubber ; for Government were more and more averse to parting with it. Among recent visitors to the Dutch Indies, he said, was M. Grisard, a well-known Rubber magnate, who he understood was on his way home to Europe now and about to float a new Company when he reached home.

SILT-TRAPS FOR RUBBER ESTATES.

FURTHER SUGGESTIONS.

With reference to our remarks last month describing a practice that might be pursued for conserving the soil on rubber estates where the lie of the land makes them subject to wash, we may add that the making of the silt-traps should be devised according to rainfall. In wet districts they should be longer and larger; also in steep land a few cross-drains of ordinary dimensions are recomended. Steep land can with safety be planted in rubber much closer than flat land, as the former gets more light, and with the dikes at the upper side of each plant it would be safe against all wash.

While Para rubber seems to like periodical flooding on flat land, it would equally rejoice in the gradual percolating of the rain water caught in the silt traps. When cattle are kept, an ideal cultivation would be dead level rows of guinea grass—double rows, taking care not to put any too near the rubber plants. This grass is very harmless and would disappear when the

rubber branches join overhead. A good story is told of a young Scotish S. D., who got up a regular rebellion with his weeders. The P.D. came out and, asking the meaning of it all, was told: "Can you no see what I am doing?" He had had all the weeders weeding *uphill*, a thing they simply cannot do. "Well," said he, "Mr. —— they have been pulling all yer soil down to the river for the last 30 years, and *I'm tryin' ma best ta get it back for ye*"!

We are told of one coffee Superintendent who used to pursue tedious searches for his pickers, tracking them in the trodden down weeds; pickers on that estate had to tread down the weeds round the coffee trees before they could start the picking!

"THE FERTILISING INFLUENCE OF SUNLIGHT."

This is the subject of an article in *Nature* of Feb 17th, to which our attention has been directed. It is written by Mr A Howard, Imperial Economic Botanist of Pusa Research Institute. and Mr G L C Howard, also of that Institute. It notices what we have already dealt with some months ago, the discovery of Drs. Russell and Hutchinson that partial sterilisation of the soil by heating or by poisons leads to an increase in the supply of nitrogenous compounds and to increased fertility. These discoverers had also asked:—"Is it possible to suppress the phagocytes, which live on bacteria in ordinary field soils, by any economical and practical process?" The answer is in the statement that the best cultivators (ryots) in the Indo-Gangetic plain for centuries past expose the alluvial soils of the plains of India to the intense heat and light of the Indian hot weather in April and May. The beneficial result on the succeeding crop is extraordinary, and has all the effect of a nitrogenous manuring. Except in market-garden crops near the cities and in crops like sugar-cane and tobacco, manures—it is stated—are but little used in India. The extended use of cheap light iron soil-inverting ploughs during the hot dry weather after the *rabi* harvest would do much to bring about a better exposure of the soil to the sun, and a more complete sterilisation. The wooden ploughs now in use are not adapted to open up the heavier lands unless they are moistened by rain, and in consequence a large area of the arable land is not ploughed at all until the monsoon. The Messrs. Howard consider one of the greatest improvements possible in Indian agriculture would be to impress on the ryot the value of weathering all arable lands in April and May to a much greater extent than is done at present. In collaboration with Mr H M Leake, economic botanist to the Government of the United Provinces—the well-known old Dulwich boy and Cambridge Scientist, youngest son of Mr W Martin Leake (Ceylon Association Secretary)—the Messrs. Howard referred to have had in progress for the past five or six months a series of experiments in which the practical effect of weathering during the hot months on both the yield and quality of wheat is being ascertained.

TEA EXPERIMENTS AT PERADENIYA.

A most valuable and interesting Peradeniya Gardens' circular, which has just come to hand is one, exceptionally well illustrated, describing the tea plots at the experiment station, Peradeniya. It should certainly be purchased by all the tea planters. After a full account of what has been done at the experiment station, conclusions, pointing conclusively to the great benefit to be derived from green manuring, even without the aid of artificials, are given. The best green manure for the elevation and soil, it is stated, is the Dadap, and the next Crotalaria. It is not advisable, however, to sow the latter unless there is sufficient labour on the estate to cut it at the right moment. The statements that Crotalaria is liable to cause serious diseases if grown as a green manure are misleading; when cut at the right moment, while soft and green and before flowering, it is harmless. There is no class of green manure that will give so much material in the first twelve months after sowing, nor disintegrate the soil so completely by its root growth. A plan of the experimental plots is given, there are several tables, and the photographic reproductions illustrate a view of Crotalaria, Dadap and Albizzia plots, a plot manured with cattle manure, showing the rested bushes, and a 'singlo' indigenous plot, showing vacancies from removal of inferior jat bushes.

"FERTILISERS FOR TEA."

South Indian Scientific Officer's Paper.

The information contained in the following notes has been kindly supplied by the proprietor of several South Travancore tea estates for publication for the benefit of tea growers:—

The estates in question are at elevations ranging from 1,200 to 3,000 feet, the temperature ranging from a minimum of 64·65 degrees in December and January to a maximum of 87-88 in the same months, the average minimum being 68, which is also the minimum from May to November, and the average maximum 83. The annual rainfall is about 168 inches, the dry season lasting from November to March, the average rainfall for the three months from January to March being only 4·2 inches. The wet season is from April to November with an average of 161·2; June, July and August being the wettest months.

The soil is a fairly free loam containing decomposing Gneiss and Cabook. It has a fair mechanical condition, but chemically it is somewhat deficient in Nitrogen, Magnesia and Phosphoric Acid. It also contains very little of the lower oxides of Iron, but a fair amount of Potash which would be rendered available by cultivation. The mechanical analysis was:—

Fine soil passing	90	mesh	..	20·00
do.	do.	60	mesh	..	29·00
Medium	do.	20	mesh	..	3·00
Coarse sand and small stones				...	48·00
					100·00

The essential parts of the chemical analysis showed:—

Organic matter	...	8·90
Oxide of Iron and Manganese	..	7·20
Lime	...	0·10

Magnesia	..	0·043
Potash	...	0·138
Phosphoric acid	..	0·038
Containing Nitrogen	..	0·140
Acidity	...	fair

One field of tea, 22 years old, before manuring showed a falling off in yield, the leaf being of poor quality and growing to banji before the shoot had time to mature. In 1906 this field was given an application of Fraser's mixture at the rate of 729 lb. per acre; in February 1908 an application of Parry's manure at the rate of 1,015 lb. per acre; and again in February 1909 an application of Parry's manure at the rate of 640 lb. per acre.

The crops were as follows :—

1904	796 lb. per acre.	1907	376 lb. per acre.
1905	463 do.	1908	1,013 do.
1906	590 do.	1909	982 do.

The trees have now quite recovered their vigour.

The following is a comparative statement of the cost of Fraser's mixture (Colombo) and Parry's fertiliser with equal strength per acre of essential fertilising ingredients, viz., Fraser's 840 lb. and Parry's 1,000 lb. per acre, and the actual cost on the estate including transport :—

Strength per cent in essential fertilising ingredients. Nitrogen.	Phos-phoric-acid.	Potash.	Composition of Mixture.	lb. per acre.	Nitrogen.	Phosphoric acid.	Potash.	Cost per Ton. R. ct.		Cost per Acre. R. ct.	
Colombo mixture.											
6·5	1·5	1·5	Castor cake ..	250	16·25	3·75	3·75	91	92	10	26
7·75	..	..	Ground nut cake ..	194	14·96	..	..	109	42	9	48
6·5	3·0	..	Fish ..	100	6·5	3·0	..	96	92	4	33
20·5	..	..	Sulphate of ammonia 95 per ct	116	23·49	..	..	254	42	13	18
12·5	..	42·0	Nitrate of potash ..	80	10·0	..	32·6	244	42	8	74
..	..	51·0	Sulphate of potash ..	50	..	..	25·5	191	42	4	28
..	46·0	..	Concentrated superphosphate	50	..	23·0	..	189	43	4	23
				840	1·2	29·75	62·85	148	33	54	50
Parry's Fertiliser.											
7·16	3·08	5·02	Sulphate of potash—1 part; Castor nut cake, Ground cake } 10 parts; Bones — 1 part	1000	71·6	830·	50 2	93	00	41	80

Parry's fertiliser thus shows a saving of R13 per acre. It costs at Ranipet R78 F. O. R. Planters will join me in thanking the proprietor of these estates for so generously supplying the above very valuable information, and it would interesting to hear how these results compare with those obtained by others in different districts.

RUDOLPH D. ANSTEAD, Planting Expert.

—*Planters' Chronicle*, April 16.

PLANTING METHODS: AND TAPPING SYSTEMS.

IMPORTANCE OF CAPABLE AND EXPERIENCED MANAGEMENT.

(*To the Editor of the "Financier.*")

As a constant reader of the *Financier*, will you permit me, through the medium of your valued columns, to make a few remarks upon an article entitled "Wide Planting—A Dutch View," emanating presumably from a Mr van Romuude, which appeared in your issue of March 29th?

1. The Extent and Method of Tapping.—The first words I would draw attention to are the following :—

After noting that little is yet known *re* the extent to which the Ficus elastica and the Hevea brasiliensis may be tapped at one time, and also on the best methods of effecting this operation, he (Mr van Romunde) says science and experience enable us to reach some kind of working basis.

With regard to the first part of the above, I fancy a good deal is known of the extent to which Hevea brasiliensis, at any rate, will 'stand' tapping, though I admit that little is known of the effect it may eventually produce on trees systematically tapped in artificial plantations throughout a normal lifetime; that is to say, the normal period of economic utility on normal plantations has only been surmised, and has not, so far as I know, been yet definitely determined.

With regard to the 'best methods of effecting this operation,' there cannot to my mind, for physiological reasons, be any two opinions as to what principle of tapping is theoretically correct. As Professor Fitting clearly demonstrated in a most able treatise lately published, the effect of incisions on any tree must cause a local disorganisation of the conveyance of plant food from one part of the tree to another. The water and nutrient salts in solution which are obtained from the soil by the roots (principally the root hairs), and conveyed through the sapwood tissue (phloem) up to the leaves, are there combined with the products of assimilation of the leaves, that is, mainly carbon (the oxygen of the $CO_{\frac{1}{2}}$ being returned to the atmosphere), to form complex carbohydrates, such as sugar, starch, etc., which are again conveyed down the stem, principally through the bast. The natural direction is vertically downwards. The more a system of tapping approximates, therefore, to what is known as "ringing" or "girdling," the more irregular must be the flow of the plant-food, and consequently the greater the difficulties placed in the way of its reaching all parts of the plant quickly and efficiently. For this reason I am particularly averse to the half-spiral and full-spiral systems of tapping, particularly the former, which, if carried out with two vertical channels, one on each side of the tree, is tantamount to "girdling," and the tree's recovery then depends upon whether the reserve material stored in the reservoir ducts below the girdle is sufficient to keep the tree going till the cambial layer or creative tissue has bridged the wound with "wound calli," and restored the communication.

With regard to the full spiral system of tapping, the enormous number of transverse cell-walls that the sap must have to negotiate before it can get down must render its progress very slow, thereby minimising its usefulness.

I have always considered the herring-bone system the most rational and theoretically the most correct, because as long as a clear space is left on either side of the tree (i.e., not allowing the lateral arms to overlap) there is always room for the sap to follow a natural and normal course.

THE QUESTION OF WIDTH.

(2) The articles goes on :—

One thing sure is that they must grow so widely apart that neither under ground nor above ground may they interfere with each other's development, and the study of this point has led to the acknowledment of 15, 17 or even 20 or more feet intervals as desirable, for in the struggle of the trees for the mastery even the surviving fittest suffer severely, and their development is delayed, to obviate which thinning is resorted to, and must be started as soon as the struggle begins, etc., etc.

In spite of the above statement, we find under the last heading of "initial close plantiug" the words: "A maximum production is better assured by initial close planting, for, if widely done at first, we find awkward unequal gaps later on."

Can anything be more contradictory? And why should the gaps occur if the operation known as "supplying" is properly attended to from the beginning? I must confess that on the numerous well-managed estates that I have seen in Ceylon, South India, &c., the gaps have been conspicuous by their absence, and the trees extremely even when planted 20 ft. by 20 ft.

EFFECT OF CLOSE PLANTING.

In forestry, by close planting of timber species, such distances as 3 ft. by 3 ft. and 4 ft. by 4 ft. are implied, and I assume the article refers to distances of this kind. Close planting intensifies the struggle for existence, and generally speaking, the closer the planting the keener the struggle; but I hardly think it is strictly correct to say, "for in the struggle of the trees for the mastery even the surviving fittest suffer severely." At any rate, this is an extremely far-fetched way of looking at it, and tends to be misleading. The struggle for existence commences as soon as the young trees begin to interfere with, and crowd, each other. In this struggle three distinct types of trees are established, viz.:—

(a) Dominant trees. (b) Dominated trees.
(c) Dead and dying trees.

Wherever possible trees of class (c) are left as a covering to the soil, unless they are interfering with the development of members of classes (a) and (b), or where their usefulness as convertible timber is greater than their utility as a soil covering. After a certain period, therefore, class (c) is eliminated from the struggle, which goes on between (a) and (b). It is now that the skill of the "thinning operation" comes in. For example, if a dominant tree is keeping back two dominated trees, the crowns of which could quickly expand and fill the gap caused by the removal of the dominant tree, it would obviously be correct to fell the latter. Again, if a dominated tree were interfering with the proper development of a dominant, or a more promising dominated tree, it would be correct to remove it, and so on. This process of elimination goes on until the regeneration fellings are reached, when the process changes to the leaving of those likely to prove the best "parent" trees. Lastly, at the period of the rotation, the final felling takes place.

CLOSE PLANTING.

Now, with regard to the effect of close planting on individual trees, it stands to reason that the closer the planting, the greater is the check on lateral growth, and, therefore, the greater the development in the only possible direction, namely, upward. The result is a plantation of long, whippy stems closely crowded together with small conical-shaped crowns, all jostling and crowding one another to get up to the light. Now is the time when, by judicious periodical thinnings, the crowns of the better trees are given more room, made to spread out umbrella-wise and by having more leaf surface spread out to receive the sun's rays, more CO_2 is absorbed, more plant food is formed, and consequently, girth increment is quickly added, giving the tree stability. I take it that the words "for, in the struggle of the trees for tho mastery, even the surviving fittest suffer severely," refer to this delaying of the ability of the trees to put on girth increment. But surely there is no suffering here, for though the surviving fittest are not adding girth increment at first, they are reaching the light, vanquishing their fellows aud so qualifying themselves for girth increment later on, and that is why I think these words, and also the subsequent words, "with close planting, the improvement of the crown is stimulated," are somewhat misleading and contradictory. In this latter case, absolutely the reverse to stimulation of the crown is the result until the surviving trees have established their predominance.

EFFECT OF WIDE PLANTING.

Conversely to the above, the effect of wide planting is to lessen the struggle for existence proportionally, and so increase lateral growth by stimulating, through the medium of light the activity of adventitious buds, and to diminish the intensity of upward growth. The result is a bushy formation at first, developing into an umbrella-shaped, short-stemmed tree. Fortunately, in the case of Hevea, the strong, warm, forcing soils and hot-house, tropical atmospheres in which it thrives best have given it the characteristic, under such conditions, of a clean, whippy stem from the initial stage, as opposed to the undesirable bushy formation.

Now, in the case of timber production, the object aimed at is the production of the greatest possible amount of timber per unit of area, whilst in the case of Hevea, and, in fact, all rubber-producing species, the object is the production of the greatest amount of bark surface for tapping, for the greater the bark area the greater the amount of laticiferous tissue.

Given, therefore, the above favourable characteristic of Hevea, wide planting enables it to spread out its crown to the sun without interference from its neighbours, which it would appear to begin to do from the age of about three years onward.

With a planting distance of 20 ft by 20 ft, therefore, each tree would have a crown spread of 20 ft at the widest part and an outside circumference of something over 60 ft. In Brazil, where the Hevea, in its indigenous forests, has to participate in the struggle for existence, the surviving trees often attain great height and girth, but then the ago at which tapping is commercially possible is probably much greater than in artificial plantations, where it is given full

(Continued on page 464.)

CEYLON TEA ESTATES AVERAGES: COLOMBO SALES 1910 TO MARCH 31st.

[SPECIALLY COMPILED FOR A. M. & J. FERGUSON.]

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Name.	lb	Av.
Westward Ho!	30921	62·87
Monkswood	30600	62·14
St. Johns	28578	61·12
Tullybody	39451	60·44
Court Lodge	36740	59·70
Denmark Hill	35974	58·96
Glassaugh	58947	58·38
North Cove	28596	58·08
Wanarajah	94250	57·96
Tommagong	21834	57·29
Naseby	20008	57·01
Gonapatiya	26256	56·82
High Forest	113214	56·75
Preston	26401	56·55
The Scrubs	32605	56·45
Hornsey	49732	55·45
Gonakelle	22697	55·12
Agra Ouvah	75540	54·90
Loinorn	29259	53·89
Tientsin	23530	53·82
Agra Elbedde	30469	53·67
Maha Uva	47333	53·66
Harrington	35219	53·57
Inverness	85605	53·37
Glasgow	88109	53·08
Blink Bonnie	25936	52·97
Middleton	65870	52·71
Bramley	40607	52·33
Palmerston	26527	51·87
Mocha	53038	51·72
Cleveland	12706	51·64
Mossend	3681	51·41
Marigold	26012	51·18
Ingestre	70513	50·66
Fairlawn	45533	50·57
East Fassifern	16981	50·48
Coreen	41263	50·34
Ireby	28470	50·27
Ormidale	28849	49·91
Glentilt	72294	49·57
St. Vigeans	14556	49·50
Pedro	71069	49·44
Ardlaw and Wishford	56446	49·40
Waldemar	47193	49·25
Dunnottar	22591	49·24
Gampaha	65847	49·17
Queensland	33982	48·88
Mt. Everest	15070	48·83
Highfields	62130	48·72
Seenagolla	14257	48·60
Killarney	42866	48·55
Theresia	48937	48·51
Warleigh	24267	48·41
Stafford	9910	48·41
Gangawatte	32705	48·36
St. Clair	105861	48·35
Dambagastalawa	23201	48·29
Richmond	2615	48·29
Logie	26941	48·25
Simla	12531	48·13
Lyegrove	8164	48·00
Avondale	17198	47·98
Annandale	26793	47·98
Ladbroke	19068	47·94
Callander	17557	47·87
Dovedale	3978	47·82
Lameliere	59934	47·77
Faithlie	16815	47·56
Binioya	45830	47·53
Invery	67551	47·47
Moray	65285	47·47
Bunyan and Ovoca	64143	47·47
Kenmare	4215	47·31
Munukettia	27501	47·30
Detenagalla	28173	47·26
Robgill	23018	47·16
Devonford	21476	46·97
Rickarton	23814	46·81
Holbrook	7790	46·70
Camnethan	30776	46·67
Donachie	14044	46·67
Erlsmere	34925	46·67
Winwood	31158	46·66
Evalgolla	26025	46·56
Ravenscraig	16392	46·51
Rookwood	58912	46·50
Melton	28234	46·38
Dunkeld	43279	46·23
Kincora	25862	46·16
Muirburn	45978	46·15
Harrow	45898	46·12
Deaculla	27912	46·07
Monte Christo	54955	46·06
Unugalla	41358	46·00
Battalgalla	68331	45·96
Stamford Hill	28690	45·96
North Punduloya	11910	45·95
Cecilton	15810	45·91
Avon	34086	45·90
Minna	15364	45·87
Glen Taffe	21325	45·80
Mount Vernon	47172	45·80
Westmorland	21228	45·78
Clarendon	28381	45·63
Adisham	49966	45·58
Attampettia	47703	45·53
Bandara Eliya	158601	45·47
St Evelyn	17678	45·45
Florence	111706	45·37
Templehurst	21170	45·36
Maymolly	40216	45·26
Cranley	21450	45·22
Elemane	14605	45·13
Stubton	17730	45·11
Verelepatna	52960	45·06
New Valley	39501	45·05
Kelaneiya & Braemar	43610	45·00
Grange Gardens	25870	45·00
St Mary's	11831	44·92
Brownlow	56490	44·91
Tonacombe	47715	44·83
Lucky Land	26200	44·82
Mahatenne	15747	44·81
St. Clive	13287	44·80
Delta	27081	44·76
Kinross	16699	44·76
Tymawr	86456	44·75
Queenwood	18166	44·62
Wattamulle	9507	44·61
Strathspey	20306	44·56
Talgaswela	42974	44·50
Marlborough	132122	44·45
Wattagollie	22048	44·41
Queenstown	33050	44·36
Rookatenne	29158	44·35
Roeberry	54620	44·33
Donnybrook	37751	44·29
Panilkande	70890	44·27
Cabin Ella	28586	44·25
Uvakellie	46111	44·24
Opalgalla	21555	44·24
Templestowe	52159	44·23
Glenanore	12664	44·13
Meeriatenne	11036	44·13
Nonpareil	27663	44·10
Shawlands	47145	44·09
Weygalla	20685	44·05
Columbia	15183	44·05
Oakwell	31966	44·00
Walton	15600	43·98
Bittacy	19322	43·97
Oonoogaloya	54800	43·92
Kirklees	46912	43·90
Hatherleigh	42064	43·87
Poolbank	17660	43·84
Gallola Div.	16140	43·84
Rambodde	20938	43·78
Glengariffe	28166	43·74
Upper Ohiya	27217	43·68
Agra Tenne	17660	43·63
Galapitakande	30150	43·62
Deviturai	64615	43·60
Osborne	27126	43·55
Beauvais	17624	43·54
Manickwatte	17238	43·52
Hyndford	22969	43·47
Nyanza	24551	43·40
Waga	11147	43·36
Craigmore	10739	43·32
Penrhos	38499	43·27
Little Valley	15144	43·27
Orion	64781	43·26
Hatton	29510	43·24
Sylvakandy	140130	43·22
Blairlomond	9861	43·18
Bopitiya	40456	43·17
Dickapitiya	21665	43·17
Baddegamma	38626	43·13
Ambragalla	120702	43·12
Mahagalla	32755	43·11
Genekeriya	6545	43·11
Poonagalla	48058	43·10
Eastland	12880	43·09
Rahatungoda	21229	43·07
Mousakellie	15106	43·07
Troup	8695	43·06
Alma	14849	43·05
Temple Land	16564	43·00
Pembroke	5018	43·00
Battawatte	48560	42·93
Hanagalla	32575	42·92
St. James	12828	42·92
Gallinda	23185	42·88
Mincing Lane	16505	42·82
Theydon Bois	28950	42·82
Birnam	30544	42·76
Mansfield	23311	42·76
Mousa Eliya	27090	42·72
Errollwood	31443	42·70
Waragalande	39529	42·69
Madulkelle	34102	42·69
Bollagalla	25445	42·69
Vogan	127105	42·67
Ottery	78005	42·64
Meath	7065	42·64
Tempo	52055	42·63
Anningkande	10545	42·61
Somerset	6648	42·59
Ampitigoda	21331	42·51
Macaldeniya	33952	42·50
Tamaravelley	33824	42·49
Dunbar	34975	42·48
Nakiadeniya	66112	42·47
Yelverton	19989	42·47

Name	lb	Av,
Kehelwatte and Bodawa	15703	42·45
Rilpolla	11940	42·44
Hangran Oya	26525	42·40
King's Grange	24844	42 39
Dambagalla	4870	42·37
Coventry	28120	42·35
Kurulugala	24751	42·33
Glendon	40895	42·30
Glen Esk	11600	42·27
Great Valley	65144	42·26
Gonanagalla	49085	42·25
Carfax	16971	42·25
Doonevale	12475	42·25
Castlereagh	50230	42·21
Demoderawatte	13290	42·21
Abergeldie	17410	42·20
Labuduwa	5220	42·16
Whyddon	24443	42·12
Ben Nevis	5099	42·11
Galleheria	34275	42·10
Polgahakande	16445	42·10
Gingran Oya	32867	42·09
Morahela	39009	42·08
Ingeriya	24334	42·07
Koslande	38635	42·03
Waverley	3458	42·00
Ashbourne	2143	42·00
Porapass	32260	41·98
Newburgh	51271	41·95
Donside	6199	41·95
Deemaya	32830	41·93
Wallawe	24674	41·87
Glenalmond	6805	41·82
Pallagodde	58015	41·79
Hardenhuish	25882	41·77
Nellicollaywatte	25923	41·76
Gwernet	9130	41·73
Amherst	8210	41·69
Natuwakelle	45500	41·69
Deniyaya	52600	41·67
Belton	10045	41·66
Richmond Hill	16097	41·65
Bullugalla	55245	41·55
Sanquhar	21302	41·51
Neuchâtel	77140	41·50
Old Maddegama	20577	41·49
Neboda	79021	41·48
Beverley	44790	41·47
Torwood	48013	41·46
Ardenlee	7811	41·44
Knavesmire	71667	41·42
Laxapanagalla	47678	41·41
Panmure	29350	41·41
Meddegodde	13995	41·40
Yahalatenne	99089	41·37
Beausejour	15465	41·33
Choisy	74545	41·32
Farnham	18505	41·31

Name	lb	Av,
Coldstream Group	21155	41·30
Swinton Div.	39642	41·28
Walpita	25743	41·25
Marie Land	85262	41·24
Bambragalla	3540	41·22
Shannon	20955	41·20
Glencorse	31670	41·18
Ferndale	23475	41·17
Bowhill	18230	41·17
Nadoo Totum	45518	41·14
Harangalla	54394	41·13
Andangodde	11716	41·11
Keenagahaella	17206	41·09
Kellie	32065	41·08
Sannos	7920	41·08
Raxawa	19267	41·07
Hillside	8961	41·04
Hauteville	3928	41·02
Igalkande	20085	40·93
Awliscombe	6095	40·92
Mossville	63743	40·90
Odoowera	21440	40·83
Kehelgama	19164	40·83
Dumbugodde	36780	40·81
Bowlana	20943	40·80
Perth	57504	40·78
Rosemont	14224	40·78
Nugagalla	17250	40·73
Leangapella	15520	40·72
Tembiligalla	60705	40·71
Theberton	17079	40·70
Geragama	66730	40·70
Dalukoya	16620	40·69
Anniewatte	6510	40·68
Stonyhurst	31665	40·67
Ganapalla	58642	40·65
Ferriby	19957	40·64
Clyde	64088	40·63
Murraythwaite	11610	40·63
Kobbakaduwa	16590	40·56
Ormondale	12013	40·55
Wiharagama	9048	40·55
Halloowelle	19751	40·53
Massena	19165	40·53
Looloowatte	19905	40·52
Dangan	9035	40·52
Mousadella	18517	40·47
Nahavilla	27620	40·42
Waitalawa	38340	40·41
Ambagasduwe	6341	40·41
Hathmatte	26253	40·39
Pattipolla	16420	40·36
Nugahena	18411	40·32
Kempitiya	8077	40·31
Tismoda	56990	40·28
Gondanawella	6526	40·26
Siriniwasa	26840	40·25

Name	lb	Av.
Girindi Ella	25608	40·25
Forest Creek	12272	40·22
Nahalma	54255	40·21
Lowmont	6284	40·21
Cotta	39125	40·20
Radella	5126	40·20
Myraganga	45599	40·16
Atherton	16094	40·13
Muendeniya	46172	40·11
Tunisgalla	35596	40·11
Tavalamtenne	28390	40 05
Semidale	47622	39·97
Clydesdale	3607	39·96
Mowbray	13036	39·88
Horagalla	5958	39·88
Longville	20405	39·86
Pindeni Oya	39274	39·85
Monrovia	17240	39·85
St. Heliers	34072	39·84
Rosita	3035	39·83
Agra Oya	37956	39·82
Lonach	35576	39·80
Munangala	14520	39·80
Dimbulkande	11060	39·80
Owilikande	41370	39·75
Jak Tree Hill	24493	39·75
Elston	70338	39 72
Warakamure	48105	39·70
Kintyre	7008	39·70
Carney	3265	39·70
Harrisland	3820	39·68
Ellawatte	11440	39·63
Puspone	38819	39·62
Findlater	31244	39·62
Olympus	24656	39·62
Moredukande	4756	39·62
Rothes	4675	39.62
Carolina	6258	39·57
Kandaloya	49770	39 56
St. Aubins	10349	39·55
Culloden	8172	39·54
Charlie Hill	4910	39·54
Ankande	19893	39·53
Talawitiya	15815	39·50
Purana	8894	39·50
Sirikandura	28110	39·46
Paniyakande	16425	39·45
Mahalla	4224	39·43
Maligatenne	3543	39·41
Katugastota	7555	39·40
Sapumalkande	59970	39·38
Yellangowry	29035	39·36
Erracht	57754	39·34
Hegalla	34644	39·33
Kannatota	7190	39·28
Maldeniya	42290	39·27
Wella	19500	39·27
Ruanwella	55622	39·26
Salawe	14565	39·26
Noorani	13610	39·14
Ingrogalla	32330	39·14
Mt Temple	47890	39·10

Name	b	Av.
Pansalatenne	51303	39·05
Kitulgalla	46779	39·05
Ballywatte	28188	39·02
Alpha	26535	39·00
Maskeloya	6244	39·00
Warwick	2573	39·00
Knuckles Group	11680	38·98
Balado	31390	38·98
Dikmukalana	12019	38·95
Alludeniya	9048	38·94
Taprobana	13220	38·91
Ettapolla	4750	38·88
Morton	15290	38·87
Gadadessa	9962	38·87
Labugama	18190	38·85
Kabragalla	7172	38·82
Galata	31032	38·79
Silva Land	30597	38·78
Goolshaneally	32487	38·77
Higham	29598	38·77
Torrington	16560	38·75
Cooroondoowatte	50187	38·73
Mipitiakande	16280	38·73
Parambe	30595	38·72
Eila	56910	38·70
Kiriporuwa	49277	38·68
Citrus	38625	38·65
Berry Hill	2615	38·65
Allingford	20855	38·62
Kudaganga	3767	38·62
Udawatte	7960	38·61
Irex	29008	38·59
Oonanakande	15440	38·58
Clunes	35925	38·55
Matale	22650	38·54
Aigburth	23896	38·50
Walahanduwa	17810	38·50
Moragalla Group	6515	38·50
Suduganga	15670	38·49
Karagahatenne	13422	38·41
Moragalla	3390	38·39
Bellongalla	29670	38·38
Heatherton	13251	38·38
Palm Garden	15015	38·34
Erin	23665	38·31
Freds Ruhe	17000	38·31
Narangoda	25180	38·29
Glenugie	6775	38·29
Avisawella	62967	38·26
Shrubs Hill	39912	38·26
Balgownie	16024	38·26
Ambalawa	13752	38·26
Vicarton	6605	38·17
Welikande	19805	38·15
Mahagoda	2535	38·13
Elchico	11730	38·11
Mentmore	19090	38·11
Kituldeniya	24300	38·11
Footprint Group	9935	38·08

Name.	lb.	Av.
California	1965	38·08
Mahawale	133743	38·06
Embilia Oya	32088	38·05
Summer Hill	2384	38·05
Newmarket	7918	38·00
Yoxford	1330	38·00
Wewawatte	17511	37·88
Widworthy	11170	37·88
Aldie	4502	37·87
Tokkatia-mulle	3972	37·87
Damblagolla	16134	37·87
New Angamana	41845	37·87
Doolhena	12836	37·82
Millewa	40860	37·82
Gona	49826	37·76
Headington	3785	37·75
Kuruwita	5165	37·72
Halbarawa	8508	37·70
Goodhope	32637	37·68
Kanuketiya	4980	37·65
Gonamade	3459	37·63
Udaveria	2834	37·57
Elfindale	26701	37·56
Yahalakelle	43095	37·50
Burnley	6915	37·42
Lynsted	4235	37·38
Kalupahana	8581	37·35
Chapelton	6347	37·35
Moorland	46109	37·22
Pinneduwa	11469	37·21
Vellearuna	17234	37·20
St Martins	7620	37·20
Patulpane	6960	37·20
Wepalle	1638	37·17
Lyndhurst	14653	36·97
Golconda	1777	36·90
Bridstowe	16043	36·84
Candawatte	4544	36·73
Burulugo-della	5105	36·64
Nilloomallay	12385	36·61
Laurawatte	35599	36·56
Edward Hill	2989	36·48
Eilandhu	2525	36·48
Oxford	47138	36·41
Ederapolla	11625	36·38
Ninfield	12825	36·38
Bogawan-talawa	4330	36·35
Darrawella	3873	36·32
Sadamulla	6472	36·31
St Ives	8256	36·24
Kalugama	30183	36·20
Hantane	47590	36·18
Hatdowa	6983	36·17
Sidmouth	51550	36·05

Name	lb.	Av.
Glendale	5000	36·00
Panville-kande	5340	35·98
Panvilla	7371	35·98
Medenham	22820	35·94
Uragalla	1389	35·94
Balantota	52511	35·91
Romania	17110	35·90
Karawkettia	6349	35·70
Parusella	4209	35·70
Lantern Hill	33367	35·70
Bloom Park	9232	35·58
Glenorchy	4520	35·58
Andiatenne	31788	35·57
Bowella	15556	35·42
New Rasa-galla	14990	35·42
Patchakadu	9240	35·35
Agrakande	3011	35·29
Alplakande	1876	35·28
Florida	10272	35·28
Katukurun-doya	2085	35·20
Poilakande	56390	34·90
Agars Land	14995	34·85
Sudangedere	4420	34·84
Vendoola	2874	34·84
Strathdon	2940	34·79
Lebanon Group	10456	34·67
Kulupane	9775	34·57
Madala	4742	34·52
Spring ale	3230	34·51
Hatale	8398	34·45
Ellawalla	7448	34·36
Deligama	4740	34·35
Lindoola	3755	34·27
Kelburne	3505	34·10
Kelani	72817	34·10
Pingarawa	7095	34·00
Easton	2114	34·00
Katooloya	9112	33·75
Watawella	3904	33·75
Hapugas-tenne	16500	33·63
Aranayake	6005	33·49
Nikakotua	5875	33·40
Springwood	8400	33·36
Mariawatte	6267	33·10
Ingoya	6451	33·02
Hopewell	9178	33·00
Gatagaha-wala	32330	32·89
Atgalla	8800	32·71
Laxapana	6880	32·70
Lorne	13960	32·62
Kalduria	3610	32·60
Kehelwatte	5532	32·56
Alver	11701	32·56

Name	lb	Av
Abbotsford	5370	32·12
Hunasgeria	1674	32·07
Sunnycroft	1138	32·04
Meddakande	6492	31·97
Kotagaloya	11215	31·96
Galatura	4509	31·77
Berragalla	2522	31·74
Hoolankanda	2125	31·73
Rutland	3680	31·57
Ury	4600	31·56
Dangkande	6432	31·52
Depedene	5660	31·50
Sandranpitty	1265	31·39
Blairavon	2390	31·37
Pendle	2810	31·28
Hill End	8146	31·24
Asgeria	4479	31·24
Mudamana	4736	31·17
Ettie	1748	31·15
Appallagoda	2100	31·10
Halgolle	8036	30·90
Glassel	6285	30·48
Digalla	3456	30·24
Maddagedera	3500	30·24
Algooltenne	2941	30·14
Arslena	1280	29·87
Iscadu	4828	29·72
Lauderdale	4005	29·63
Loolecondera	2883	29·32

Name	lb	Av
Pinnekande	6668	29·32
Galaha	7489	29·25
Wattakelle	3228	29·00
Tarawera	15540	28·95
Allakolla	3045	28·57
Nambapana	3836	28·07
Dover	3758	28·07
St. Helens	2980	28·00
Ukuwella	1600	27·75
Poengalla	1836	27·54
Attuwatte	12080	27·50
Kotugodde	2060	27·28
Avington	4880	26·96
Wahagapitiya	1277	26·68
Rayigam	5583	26·27
Kalugala	5276	26·18
Cottaganga	1400	26·00
Wandura-goda	13519	25·97
Kurugala	2029	25·89
Hologama	3851	25·78
Roxburgh	6004	25·30
Weoya	2400	25·00
Karawanella	3690	24·98
Penylan	6600	24·67
Guruwewa	3782	24·09
Ratmala-watte	8845	23·24
Elowita	22164	22·62

Green Tea.

Bowlana	5805	45·63	Udapalata	6986	38 10
Taprobana	2295	44·44	Madampe	5457	24·44
Ooloowatte	2973	44·27	Dunedin	5504	23 32
Udapolla	6894	40·31	Udabage	4250	14·70
Oakfield	27769	40·11	Kiriwana	33351	14·10

Indian.

Glen Morgan	15920	40·29	Kolam	10580	36·07
Prospect	29305	39·81	Periashola	11790	31·75
Terrace	3600	38·30			

Wynaad.

Pootoomulla	46010	33·36	Perengodda	28165	31·53

(Nilgiri Tea.)

Halashana	3520	51·13	Lovedale	9817	42·01
Thiashola	2679	42·10	Cherambadi	6113	29·29

Travancore.

Vagavurrai	35843	45·83	Isfield	31850	37·39
Lockhart	21788	44·61	Yellapatty	3900	35·30
Madupatty	104005	43·86	Perravurrai	34800	35·20
Sothuparrai	60844	43·76	Sevenmallay	34854	34·07
Chittavurrai	27110	43 44	Chakanad	6690	33·27
Surianalle	52513	43·30	Letchmi	20547	32·99
Devicolam	62367	41·23	Munjamally	1274	32·00
			Stagbrook	19592	31·91
Kanniamallay	255614	40·00	Kalaar	22403	31 75
			Munaar	27831	28·36
Ashley	22767	39·11	Koliekannm	1038	27·05

PLANTING METHODS: AND TAPPING SYSTEMS.

(*Continued from page 461.*)

play from the start, and will never attain such proportions, but is tappable at a much earlier age.

Dangers.

I do not think there is much doubt that white ants will attack living Hevea trees as well as dead ones; in fact, I myself have seen it. There is no doubt that, in view of white ants and the dreaded 'Fomes semetostis,' it is imperative the trees should be so planted that at any rate their root systems do not intertwine, and, for this reason, I fancy, most planters will agree that no planting distance less than 20 ft by 20 ft is advisable in the case of Hevea. These questions, however, can be safely left to the experience and skill of the many extremely clever and practical planters who control the local management of our Eastern and Middle Eastern estates, and who are, after all, the hub of the whole industry.

B. L. S. Winton,
(Late) Imperial Forest Service, India.
Speldhurst Lodge, Speldhurst, Kent, March 31st.—*Financier*, April 2.

M. LEPLAE'S VISIT TO THE EAST.

TOUR OF THE BELGIAN CONGO DIRECTOR OF AGRICULTURE.

VISIT TO JAVA : AN INTERESTING CONVERSATION.

It was the good fortune of one of our representatives the other day to run up against M. Leplae, the Belgian Director-General of Agriculture for the Congo, who was on his way back to Brussels to the Congress of Colonial Agriculture, after a tour in the Middle and Far East where he had been to learn under what conditions rubber is grown, what kind of soil is most suitable for it, how it should be planted, how it should be tapped, what are the best instruments for tapping, and what are the best methods of manufacturing the article. He had also, of course, taken the opportunity of making a study of other tropical products; but it was in rubber that he had been most interested in view of the fact that, after his return to Belgium, he will go on to the Congo and there have planted under his supervision 5,000 acres of *Hevea*, which, he has not the slightest doubt, is the most suitable kind.

THE PRODUCTS OF JAVA.

When M. Leplae left Ceylon on March 5th he went to Batavia and then to Buitenzorg. Here he was received by the Governor-General of the Dutch East Indies, Mr A W F Idenburg, who has been twice Minister of the Colonies in Holland, and the Director of Agriculture, Mr Lovink, who has been Director-General of Agriculture in Holland. He is now undertaking a complete re-organisation of the Department of Agriculture in Java, in which will, in all probability, be merged the Board of Trade, for, as nearly all the trade in Java is in agricultural products, they deem it expedient to make the Board of Agriculture and the Board of Trade one Department.

M. Leplae visited the botanical garden, laboratories, and museums at Buitenzorg, which with the possible exception of Pusa, near Calcutta, form the largest scientific institution in connection with Tropical Agriculture and Botany in the East. These he found very interesting. He also travelled extensively in Java, studying the estates growing sugar cane, Manila hemp, sisal, tea, cinchona, cacao, pepper, kola, coca, indiarubber (hevea and ficus), rice and other products.

MALABAR TEA : 1,800 LB. PER ACRE.

He made a special visit to the big tea factory of Malabar, near Bandoeng, which was the finest in Java. It was, he said, deemed to be perfect as regarded cultivation. They got very large returns per acre—the largest, it was believed, in the world, with the exception, perhaps, of some in Assam. The crop amounted to something like 1,800 lb. per acre. The tea was grown on volcanic soil of a very high fertility, and there was a very large amount of rain. It was perfectly cultivated and all the factory machinery was driven by electricity. It gave regularly dividends of 80 to 100 per cent.

RUBBER.

With regard to rubber, Ficus Elastica was in great favour; mistakenly, he thought. Hevea seemed to him to be much better, especially after what he had seen in the Federated Malay States. There could not be better rubber than Hevea. There were few old plantations in Java but there were very many acres under young rubber which was growing very well. This was accounted for by the very rich soil. French, English, Dutch, and Belgian Companies were frequently opening out new plantations. It was generally believed that in Java and Sumatra there were from 200,000 to 300,000 acres under rubber.

SOVEREIGN RIGHTS.

Asked as to the position of affairs with regard to sovereign rights, M. Leplae said that sovereign rights belonged, apart from Government, only to those estates which were sold prior to the Dutch occupation. All other land was leased. The Government was trying to abolish the existing sovereign rights. There was one "Society" with English capital in it that had bought an estate over which the owners had sovereign rights but as far as the majority of capitalists was concerned, the acquisition of sovereign rights by the Government would have no effect. There was only one estate in five or six hundred, or a thousand, that was not leased.

In Sumatra M. Leplae visited only an estate belonging to the Galang Co., on an island of 15,000 acres, in the Rio Archipelago, just outside Singapore. On that island 2,600 acres had been put under rubber which was growing fairly well in clay soil. Very interesting results from the use of nitrogen manure were being obtained. The application seemed to be doing a great deal of good, for trees $1\frac{1}{2}$ years old were as large as trees 3 years old on the same soil, but to which the manure had not been applied. Something like half-a-pound of guano per tree was used to start the growth in the cold, clay soil. Once they got started they grew perfectly, but if they did not start well they grew very slowly.

M. Leplae visited numerous estates in the neighbourhood of Kuala Lumpur, especially some with seven, eight, 10 and 12 year old rubber, and was very much interested in what he saw. The factories were very well equipped and many new ones were being erected, with suction gas plant machinery of 100 or more horse-power. Some of them made up to 3,000 lb. of dry rubber a day. They generally now went in for rapid coagulation, coagulating the latex in ten minutes, instead of taking a whole night as formerly. They got a better coloured rubber in this way, a paler rubber. Some, however, smoked the rubber with very successful results and one estate he visited, which smoked the whole of its No. 1 quality rubber nearly black, obtained last week the record price of 12s $9\frac{3}{4}$d a lb.

CLEAN WEEDING.

What had interested him very much was that in all the plantations clean weeding was in vogue. They were very enthusiastic advocates of clean weeding and they did not use green manure. They occasionally planted small plants

on hillsides to prevent wash, but even then they generally used Passiflora. The trees growing in estates not clean weeded could not be compared in size with the others.

TAPPING.

Another feature was that they all used 5/16 in. gouges, there were no patent knives to be found and with these they did splendid tapping work. The coolies seemed to understand the use of the gouges quite well.

DISEASES.

They were fighting diseases most successfully. White ants had been traced to be due to stumps and trunks left in the ground. These were always now removed as soon as possible and the white ants were got rid of very easily. It was only on low, swampy and peaty soil that they had trouble. On soils of this nature rubber trees grew extremely well, but

DID NOT GIVE MUCH RUBBER.

The distance most favoured for planting was 20 feet square.

Mr. Gallagher's Experiments.

M. Leplae has been very much interested in the experiments of Mr. Gallagher, the Malay States mycologist. These led to the conclusion that the best method of tapping was the one by which one quarter only of the tree was tapped. This seemed to give very good results and could be undertaken every day. The yield of rubber was estimated at 160 to 200 lb. an acre at six years and 500 lb. at ten years.

GENERAL REMARKS.

In answer to further questions M Leplae said that he thought prices would go down, but he did not think they ever would go under 3s. to 4s. a pound or that the cost of production would ever rise above 1s. to 1s. 2d. From the financial point of view rubber was a sound proposition for many years to come. There would probably be a slight drop in a few months, but not a severe one for some years.

PTEROCARPUS TREES DESTROYED BY A FUNGUS.

The last number of the "Agricultural Bulletin" of the Straits refers to a fungoid disease attacking the *Pterocarpus* trees used as shade in Penang. Mr. W. Fox, Superintendent of Forests and Gardens, and Mr. Gallagher, the Government Mycologist, together examined the diseased trees (of which some 100 are said to have succumbed) and the parasitic fungus discovered (Polystictus Occidentalis) is thought to be the cause of the disease, which, according to Mr. Massie, of Kew, cannot be suppressed by any remedial measures, though he suggests as an expedient for prolonging the life of the tree to some degree that a trench should be dug round the base and filled with a solution of nitrate of potash or soda. As the *Pterocarpus* is a common shade tree with us, it would be as well that precautions should be taken against the appearance of this disease, if it has not already appeared. In this connection we would draw attention to the treatment (referred to by Mr. Fox) adopted by Mr. G. F. Scott-Elliott in curing plant diseases, viz., a process of forcing fungicides into the tissues of the tree through the trunk. We should like to have Mr. Petch's opinion as to the value of his treatment.

TEA CULTIVATION LECTURE BY MR. ANSTEAD.

PREVENTION OF HELOPELTIS BY SPRAYING.

In an interesting lecture Mr R D ANSTEAD, Scientific Officer of the U.P.A.S.I., said :—

TEA.—I suppose that your great trouble is the attack of Helopeltis, but from what I have been shown up here, it seems to me that you have got the thing very well in hand. From what I have seen, you are doing the right thing. When the attack is really bad, you must prune it down, burn your prunings, clean up the land, and then spray. I think that the burning of prunings is the really most important thing. If under local difficulties of labour, money and time, you cannot carry out the full programme, do not let this item be neglected. Mr Antram has proved that mosquitoes will hatch out from prunings for a period of sixteen days or more, especially if these are kept fresh and green in nullahs, or by showers of rain, so you see the importance of getting prunings burned the same day, so do not neglect the burning of prunings, do not let them lie on the ground. With regard to spraying I am a great believer in prevention rather than cure. Spraying keeps the insects away from the bushes, and prevents them laying eggs to a certain extent, and so can be used as a preventive method. Once the attack is got in hand, spray the whole tea if necessary, and do not wait until the blight gets bad again. One pound of imperial soap to 20 gallons of water will work out at an application of 200 to 300 gallons per acre. Spraying is absolutely useless unless it is well done; every part of the bush must be wetted. An ordinary garden Syringe will do good work, but the spraying machine is a matter for yourselves, as your water may be near or far off. The great point to be attended to in spraying is to wet every part of each bush with the wash. I attach great importance to attacking the dieease in the very beginning. Watch your tea, and let your pluckers keep a watch for the presence of mosquito blight and have the sprayers behind the pluckers. It is at the beginning of the attack that it can be most easily stamped out; once it has got under way, it is difficult to deal with.

MANURING TO PREVENT HELOPELTIS.

I think this is an extremely important matter for tea growers to take up and will get more and more important every year. I think there is nothing like manuring to tackle Helopeltis. It is an axiom when dealing with all diseases, that to keep the plant vigorous and at the top of its health, by manuring, is half the battle. In selecting your manure you cannot look at the soil and the condition of your tea, and say you want this and you want that; you must have a starting-point. This starting-point is a chemical analysis of the soil. I strongly advise all of you to, as soon as possible, get an analysis of your soil made, and the analysis I want is one that shows the availability of plant food in the soil. I think at present with the big district that I have, that you will be wasting my time by making me do these analyses; that you should get the same done by professional chemists, and

let me have them to advise you upon. Having got the analysis I can suggest a system of manuring, and you yourselves must experiment with this. Unless your soil is in a good mechanical condition, there is not any use putting in mineral fertilisers ; you must bring up its mechanical condition first. The best thing, but of course impossible in South India, is cattle manure. Poonacs will do but they are slow. What your soils over and over again need when they are run down is humus, and this must be supplied before artificial manures are used. One way, and perhaps the best way, under local conditions of supplying humus, is to grow a green dressing and dig it in. I think you should cultivate and grow amongst your tea a local leguminous weed. I have seen numerous leguminous plants since I came to the district and I hope you will send me specimens of other likely ones to Bangalore. The best plant I have seen is a thing they have got in Mysore and the Nilgiris. It is something like the sensitive plant, but it has no thorns ; the botanical name is *Cassia Mimosoides*. I have no doubt whatever that it would grow here ; it grows in the Nilgiris in large quantities. After having got the mechanical condition back, you can go on with mineral fertilisers. There is one thing I would like to call your attention to and ask you to think about. The manure you usually use for tea consists of Poonac of some sort, bone meal, sulphate of ammonia, or nitrate of soda, and sulphate or nitrate of potash. This is applied just before the monsoon. The mineral part, the ammonia and nitrate salts, and the potash salts, are very soluble and are undoubtedly being washed out of the soil, into the drains or rivers, and carried away. This must result in a big loss, since these constituents are very expensive. I would suggest that you either manure after the monsoon, or, if you cannot do this, then, you divide the application into two, putting the Poonac and the bone before the monsoon, and the minerals afterwards. The cost of application will be greater, but the saving in the loss of manure and the increased benefit obtained from this system will more than repay the extra cost. I should like you to think this over and conduct some experiments on these lines.—*M Mail*, April 25.

CITRONELLA OIL.

Powerful Movement for Valuation on Geraniol Content.

Outstanding in the essential oil world at the present time is a strong movement to establish market conditions for citronella on a basis of purity rather than the limit of sophistication on which contracts are now formulated. The honour of developing this important matter to what promises to be a successful issue rests with the *Perfumery and Essential Oil Record*, the new departure in trade journalism which enjoys the advantage of Mr. J C Umney's editorship.

In Ceylon

a system of sophistication obtains which consists almost exclusively of the addition of Russian petroleum, and Schimmel's raised test on which practically all contracts for citronella oil are made passes from 10 to 15 per cent of this adulterant, with the result that whilst money is wasted in freight on the petroleum oil, the soap maker, who is a large consumer of citronella, gets a product which virtually is not much more than 80 per cent. of the strength of a pure oil. This Schimmel's test is devised along the following lines :—

That in the first place the solubility in 80 per cent alcohol should be determined, and then the test repeated after the addition of 5 per cent. of Russian petroleum. In the latter case the citronella oil should still form a clear solution with 10 volumes of 80 per cent alcohol.

This is a solubility test pure and simple, and the proposition now is that it should be superseded by a valuation on the basis of geraniol content, just as cassia oil is sold on its percentage of cinnamic aldehyde, and lemongrass on the citral strength. In addition, Mr. Umney has put forward, quite by way of suggestion, certain requirements as to specific gravity, solubility, optical rotation, and refractive index, and his first tentative "London standard test" for trading purposes may be tabulated thus :—

Specific gravity, 0·900 to 0·915 ; Opt. rotation in 100 mm. tube, 0 dg. to — 15 dg. ; Refractive index, about, 1·4800 ; Acetylisable constituents, at least 60 per cent. Solubility.—The oil should be soluble in 2 to 3 vols. of 80 per cent alcohol, and should remain clear on the addition of more than 80 per cent alcohol up to 10 volumes.

This, as we have explained, was a purely tentative proposal, but, having regard to the fact that it is put forward as a substitute for Schimmel's test, it is interesting to observe the

Attitude of Messrs Schimmel and Co.

to the idea. As becomes a great firm, they take a broad view of the matter—a view, indeed, that accords with their oft-repeated plea for cooperation in obliteration of Ceylonese adulteration. Naturally the famous Miltitz house cannot part with their test without a pang, and crave indulgence for it on the ground of its easy application—a condition that would not apply in the case of the proposed London standard. In acknowledging, however, that a solubility test is of a limited value, they admit that the geraniol content is of far greater moment as a guide in purchasing citronella. They add the suggestion that the oil should be tested at its place by Government chemists, and only pass into trade if it contains at least 60 per cent. geraniol and meets the official tests in all other respects ; in other words, they say a Government certificate should be granted before exportation.

We have reason for believing that Mr Umney has a large measure of support for his proposal from buyers and sellers of citronella oil, and the next step will probably be to bring these interests together, may be at the London Chamber of Commerce, so that an understanding may be arrived at to translate the movement into a permanent concrete commercial agreement.—*British and Colonial Druggist*, April 1.

THE RUBBER MARKET AND SUPPLIES.

THE STRONG FUTURE POSITION.

Latest mail advices from London show in a striking way the firm position of the rubber industry. Two years or more ago, when rubber prices were high, it was said that the Brazilian industry would be stimulated and that more expeditions would be fitted out, and that largely increased supplies would soon be the result. This, however, was by no means realised; for the production of wild para was increased by only 570 tons in 1908 over 1907, and by only 830 tons in 1909 over the 1908 production.

The present position is remarkably firm, and points to higher prices yet during this year. The whole visible supply of para rubber in the world on April 1st was 5,279 tons, against 6,038 tons at the same date a year ago, being a decrease of 759 tons. America had stocks in hand 740 tons less than in 1909; England had 289 tons less; and in Brazil at the Para warehouses the stocks were 390 tons less than in April, 1909.

The rubber received at Para during March, 1910, totalled 5,210 tons, the receipts during that month for the last 4 years being rather remarkable:

During March,	1910	...	5,210 tons
,,	1909	...	4,140 ,,
,,	1908	...	4,240 ,,
,,	1907	...	5,830 ,,

But during the period June 30th to March 31st, the Para receipts have been

32,180 tons in	...	1909-10
30,420 ,,	...	1908-09
28,680 ,,	...	1907-08
29,390 ,,	...	1906-07

There is thus every indication that the present prices will continue and even advance; and it seems unlikely that the South American output will increase to any very appreciable extent for several years to come. It is, therefore, not to be wondered at that buyers are anxious about their supplies and are prepared to buy two years ahead to be sure of a certain quantity.

TAPIOCA AND RUBBER.

An editorial note in the *Straits Agricultural Bulletin* says:—We learn that the low price of tapioca has been a considerable factor in the increase of rubber growing among the Chinese, as the tapioca growers find that at the present price it does not pay. The Dutch and Javanese, we learn from Mr de Kruyff, Director of the Department of Agriculture, do not make up the tapioca into starch, but cut the roots in two and dry them in the sun, and thus dried export them to Belgium, France and Holland, where they are utilised for the manufacture of alcohol. This cheap method might pay even while the tapioca is at so low a price.

PLANTING PRODUCTS IN SAMOA.

We learn on enquiry at the British Consulate at Apia, Samoa, under date 12th March, 1910, that the export of copra from Samoa in 1909 was 9,389 tons: and of cacao beans 386 tons. About the same quantities are expected this year, 1910. No tea is growu in Samoa. There are several large rubber plantations on one of which—a Berlin Company—the trees will probably be tapped in two years from now.

SIR FRANK SWETTENHAM ON "RUBBER AS AN IMPERIAL ASSET."

Than Sir Frank A. Swettenham none knows or could know, better the Middle East. A life spent in the service of the Empire in and about, Malaya has given him unique opportunity for the study of every enterprise, which has assisted the prosperity and development of that portion of the King's dominions. What more natural than that a new paper devoted to rubber should seek Sir Frank Swettenham's views? Sir Frank courteously placed half-an-hour of valuable time at the disposal of a representative of the *Rubber World.*

"In the light of recent events," said Sir Frank, "it is curious to look back upon the apathy of the financial and commercial world towards rubber planting. As long ago as July, 1883, Sir Hugh Low, then Resident of Perak, reported officially: 'All kinds of india rubber succeed admirably, and seeds and plants of *Hevea brasiliensis* have been distributed to Java and Singapore, to Ceylon and to India, and supplies will be forwarded on application to any person or institution which will take care of these valuable plants.' And again in February, 1884, Sir Hugh wrote: 'British capitalists have, within the exception of the enterprising merchants from Shanghai, as yet done little or nothing in Perak.' Sir Hugh's advice, however, was totally disregarded, and it was not till about 1900, 17 years later, that rubber cultivation was seriously undertaken. Since then, as you know, Ceylon with the Malay Peninsula and Archipelago took the lead in those remarkablo rubber developments which have culminated in the present boom.

"SIR HUGH LOW, THEN, WAS THE PIONEER of rubber cultivation in the East?"

"Virtually, yes," said Sir Frank; "at any rate, it was he who first drew the attention of planters and financiers to the advantage of rubber cultivation in Malaya. The Indian Government initiated the scheme, but the present flourishing condition of the rubber plantations in Malaya is really due to the care Sir Hugh lavished on the first seedlings sent to him."

"The Indian Government secured the first plants?"

"Yes. Somewhere about the year 1876," continued Sir Frank, "the Indian Government, recognising the possibilities of commercially cultivated rubber, commissioned Mr. Wickham to collect in Brazil seeds of Hevea brasiliensis, the tree from which the highest quality wild rubber is secured. Several thousands of seeds were collected and sent to Kew, and the resulting seedlings were in due course packed in wardian cases and despatched to Singapore, Ceylon, and to Sir Hugh Low at Perak. Plants from these seedlings were carefully reared in Singapore Botanical Gardens and in Perak, and, maturing in six years, seeded. From the Perak seeds were raised four hundred trees, which were planted under my own supervision while I was temporary Resident of Perak during the absence of Sir Hugh Low. Thenceforward seeds were supplied to such planters as required them. It is gratifying to know that nearly all the

money invested in rubber plantations is British; it is only lately that the foreigner has come in at all."

"What do you think of the present position, Sir Frank?"

"Well, I think, of course, that there are far too many new rubber companies being promoted. It is difficult to understand how the flotation of one or two and sometimes three companies a day can possibly be justified."

"There is, of course, an enormous demand for rubber, which is the raw material of many industries?"

"No doubt," said Sir Frank, "that some of the companies recently promoted are quite sound; but there are many that none but a lunatic, so one would think, would dream of trusting with his money."

"To what particular faults of promotion do you refer?"

"Over-capitalisation for one thing, extravagant prices paid for the estates for another, and lack of foresight. Immense areas are now being rapidly put under rubber, and three difficulties will have to be faced by the directors of rubber companies. The first is the labour question. With large areas put under cultivation there will be a corresponding demand for labour and though no doubt it can be met by China, India, and Java, it cannot be met at once. With this demand for labour, competition to secure such as there is will be keen, and wages will rise in proportion to the scarcity experienced.

"Secondly, there will be a great demand for competent, trained European supervisors, and here the shortage will be acutely felt, and competition to secure the best men has already brought about a great rise in salaries. Then until time has elapsed to permit of the due training of Europeans, incompetent men will, and must, be appointed to important positions. We shall therefore find increased expenditure augmented by wasteful management.

"Thirdly, at no distant date, certainly not later than 1915, the production of cultivated rubber will be enormous, and unless the demand keeps pace with the supply there will be a drop in prices which will severely tax resources of all but the oldest and soundest companies, besides killing the wild-rubber trade of South America altogether, for I believe wild Para rubber cannot be collected for much less than three shillings a pound."

"You think that reduction in price, combined with the increase of cost, will prove disastrous?"

"'Disastrous' may be too large a word, for I think old-established, well-managed and moderately capitalised companies—especially those with a good reserve or a second cultivation like tea, sugar or coconuts—will be able to stand the strain, but that recently established companies will only be kept going with difficulty, and that badly managed and greatly over-capitalised companies will inevitably collapse. For all that, there will have been established a great commercial, I may also say, imperial asset; and, when things have righted themselves, there will remain a great industry of which Britain may well be proud."

An imperial asset rubber has already become, and wild-cat finance must not be allowed to obscure the essential and permanent benefits to be derived from the rapid development of its cultivation and its uses. Sir Frank Swettenham's warning should not go unheeded.—*The Rubber World*, March 31.

PRODUCTS OF THE PHILIPPINE ISLANDS.

COFFEE, COCOA AND COCONUTS OUTTURNS DURING 1908 AND 1909.

We have been making enquiries of the British Consul-General in Manila, with a view to embodying this and similar information from elsewhere in our forthcoming Handbook and Directory, as to the outputs of tropical products in the Philippine Islands in the past two years. In the following tables—for which we are indebted to Mr Edward Lillingston Stouart Gordon, the Acting Consul-General—Northern Luzon, comprises that part of the country lying to the north of Manila; Southern Luzon, the remainder of the chief island. The Vizvayas comprise all the islands lying between Luzon and Mindanao including Mindoro. The statistics are based on information supplied by the Bureau of Agriculture. The Director of the Bureau states that considerable experimental planting of coffee and cocoa has been going on during the past few years, so that the output in the near future should show the effects of this. Also that where only a few trees of one or both are grown on a farm, even if in bearing, they and the product often escape the enumerator. For these reasons it would bo safe probably to add 25 per cent to the figures given. Those for coconuts are substantially correct.

Coffee is grown in all the provinces of the islands, except those of Bataan, Zambales and Ilocos Sur, on the west coast of Northern Luzon: in most parts of the country however, to a very limited extent. The largest producing provinces are Cebu with 29,468 lb., and Occidental Negros with 22,317 lb. in 1909; and close upon the heels of the latter comes Batangas which increased its production from 4,184 lb. in 1908 to 21,936 lb. in 1909. The figures are as follows:—

	1908.		1909.	
	Acres.	lb.	Acres.	lb.
Northern Luzon ...	820	44,735	785	31,214
Southern Luzon ...	289	15,774	563	28,429
Vizcayas ...	894	44,649	1,124	69,689
Mindanao ...	—	—	32	2,384
Total ...	2,003	105,158	2,504	131,716

Cebu also heads the list of provinces producing Cocoa, with an output in 1909 of 94,491 lb. Orienta Negros comes second with 49,680 lb., and Pangasinan third with 20,135 lb. Non-producing provinces are Cagayan, Isabela and Pampanga. The production tables read:—

	1908. Acres.	1908. lb.	1909. Acres.	1909. lb.
Northern Luzon ...	593	33,874	466	34,592
Southern Luzon ...	1,032	37,556	852	70,450
Vizcayas ...	1,714	117,900	3,122	221,190
Mindanao ...	138	7,329	79	7,862
Total ...	3,477	210,859	4,509	334,094

The principal Coconut-producing provinces are those bordering the Pacific Coast, a notable exception being La Laguna which produced over 20 per cent of the total output of the islands. Provinces producing over 5,000 tons are Tayabas, 14,920 tons, Samar, 11,700 tons, Leyte 6,264 tons and Bohol, 5,312 tons.

	1908. tons.	1909. tons.
Northern Luzon	4,175	4,243
Southern Luzon	56,766	57,751
Vizcayas	35,580	35,202
Mindanao	6,326	6,630
	102,847	103,826

Tea, Cardamoms, and Cinchona—we learn—are not grown in the Philippines at all.

A beginning has been made with the planting of Rubber in and near Mindanao, but it is still too early to expect any results.

DRAGON FLIES AND PARA RUBBER.

I was recently informed that Dragon Flies had been doing damage by eating the young tips of *Hevea* shoots. That Dragon Flies eat any part of a plant is an entirely erroneous idea. Their food consists of the small insects of which there are so many always flying about, and this is what they are after when they are seen hawking about all day. They occasionally settle on a twig for a rest, but when in this position are not feeding. That the Hevea shoots in question had been damaged is undeniable, but the damage was done probably by some form of aphis or blight, though this could not be found, and it is more than probable that the Dragon Flies were feeding on the blight. The larvae of the Dragon Fly are grub-like insects with large heads and formidable jaws, and are found in ponds and steams. These grubs feed voraciously on small water insects.—RUDOLPH D. ANSTEAD, Planting Expert.—*Planters' Chronicle*, April 9.

SISAL HEMP AND HURRICANES.

That sisal hemp is almost immune to hurricanes is demonstrated by Captain Calder's estate at Visari. On the exposed hills where the wind was strongest on the date of the recent blow, the sisal was hardly affected. Some of the shrubs which were leaning with the wind were readily put upright with no damage to the plant. Mr Knowles reports that at the Nasinu Experimental Station the leaves were bruised and torn from the fact that the leaves were too long for the distance between the rows. He advises those intending to plant to plant ten instead of eight feet apart.—*Fiji Times*, April 6.

INDIAN RICE.

The average area devoted annually to the cultivation of rice in India exceeds

SEVENTY MILLION ACRES,

and the number of people who consume it must amount to many hundred millions. There must, therefore, be a very great number of people directly or indirectly interested in the composition of Indian rice, which recently formed the subject of enquiry by Mr. David Hooper, F.C.S., Curator of the Industrial Section of the Indian Museum, Calcutta. The results of the investigation, however, which are recorded in a brochure recently issued in the Vegetable Product Series of the *Agricultural Ledger*, is considerably enhanced in the light of the decision arrived at at the meeting of the Far Eastern Association of Tropical Medicine, held a few weeks ago at Manila, that

BERI-BERI IS DUE TO A LACK OF PHOSPHORUS IN THE RICE

eaten by the victims to the disease. There is an immense variety of rices, differing in shape, size, weight, colour, consistence and properties, known under various names. Some are regarded as more digestible than others, and some as more nutritious or satisfying, while others are considered fragrant, sweet, medicinal or useful in the arts. No rice, however, is so lacking in phosphorus as to be the possible cause of beri-beri were it consumed in its natural state. It is the polishing which does the mischief, for this removes the skin, or pericarp, of the grain, which contains sufficient phosphorus for the system.

As a result of a series of experiments Dr. H. Fraser, who represented the Government of the Federated Malay States at the Manila Conference found that beri-beri invariably occurs in persons living on a rice diet and eating white rice which has been polished. Experiments conducted in the United States in 1904 proved conclusively that while raw rice afforded 9·88 per cent. of proteids. the brans of rice meals gave from 9·26 to 13·41 per cent. of proteids and from 9 to 14·3 per cent. of fat. and that rice dust contained from 8·5 to 11 per cent. of proteids and from 5·2 to 6·9 per cent. of fat, while polished rice as usually offered for sale contained only 6·56 per cent. of proteids. The sole object in polishing rice, which practice is largely followed in most European markets, is to make it attractive in appearance, and it only really affects people who live practically exclusively on a rice diet.

THE BOILING OF RICE ALSO REDUCES ITS FOOD VALUE,

for this removes more than half the fat, over 8 per cent. of the albuminoids, less than 8 per cent. of the carbohydrates and 17·6 per cent. of the ash; so there would seem to be good ground for the prevalent idea that the parched rice contains the most nutriment. Rice grown in India differs considerably in composition from that grown in other countries such as America, Java, Japan, Cochin-China, and there is also a great variety in the composition of the various rices grown in different parts of India. On the average, however, Indian rice, according to Mr Hooper, consists of water 12·8 per cent., albuminoids 7·3, fat ·6, starch 78·3, fibre ·4 and ash

·6. He also reminds us that the well-known chemists, O Rosenheim and S Kajuira, who recently studied the proteids or albuminoids of rice, found 7 per cent. of total proteid present in rice, of which ·14 is a globulin, 0·04 an albumin and the remainder a proteid, which, like the glutenin of wheat, is soluble in dilute alkali.

The results of the analyses of 159 samples of Indian rice are appended to Mr Hooper's Report in tabular form. The average percentage of proteid is highest in those from Eastern Bengal and Assam and Bombay, and lowest in those from Cuttack and the Central Provinces; but the most interesting conclusions are drawn, he says, from the individual analyses, where the percentage varies from 9·81 in a sample from Broach to 5·44 in a sample from Cuttack. One object in conducting these examinations has been to discover what natural circumstances have contributed to the superiority of the composition of certain grains, and it has been found that in some cases the local reputation and market value of rice coincides with its high nitrogen content. The examination has resulted in giving a prominent place to certain rices which deserve attention at the hands of cultivators as containing over 8 per cent of albumenoids, and among these mentioned are the *ambemohar* of Belgaum and the *jeera salai* of South Canara. Of 22 Madras samples two averages of 11 each were taken, and they gave the following results:—

Water.	Protein.	Fat.	Carbo Hydrates.	Fibre.	Ash.
8·94	7·10	·74	81·54	·43	1·25
11·69	6·81	1·30	79·00	·49	·98

Mr Hooper's last conclusion, and it is certainly one of the most interesting, is that the richness of the grain appears to be due not so much to the races of the plant or the appearance of the grain as to the cultivation. The grains of finest composition are found in plants grown in rich virgin soil or in lands liberally manured. Instances of this kind are found in the red rice grown in *taungya* by the Chins of Burma, in the Kanapur rices of the Carnatic and in the Kasaragod rices of South Canara. And in Mr Hooper's opinion attention to the cultivation of the rice plants in the way of manuring the land appears to be one of the principal means of improving the quality of the grain for commercial and edible purposes.—*M. Mail*, May 3.

SCALE ON PARA RUBBER.

Specimens of a shiny black insect on young shoots and leaf stalks of *Hevea* have been received. The same scale has been noticed on the leaves and young shoots of Cearâ rubber. This scale has been identified by Mr E E Green, the Entomologist for the Ceylon Government, as *Lecanium nigrum*: another species added to the list of *Lecanium* pests on Southern India Estates. Mr Green writes, with reference to this scale, "It occurs not uncommonly on the leaves and young stems of Hevea in Ceylon, but has never shown signs of developing into a serious post." It should, however, be carefully watched and should it show any signs of becoming a pest here it should be promptly sprayed.—(Signed) H. C. Westaway, Hon. Secretary, U. P. A. S. I. —*Planters' Chronicle*, April 30.

MYCOLOGY AND ECONOMIC BOTANY.

Two numbers of the Botanical series of the Memoirs of the Agricultural Department of India which have recently been published are worthy of more than mere passing attention, in that a perusal of their pages seems to indicate somewhat clearly the trend of research which is likely to be followed in Economic Botany and its subsection, Mycology, in connection with agriculture. The first paper is by Dr. Butler, the Imperial Mycologist, upon the wilt disease of red gram. . . . What has now proved to be a harmless form in connection with red gram will probably prove to be so also with pepper, and it remains for the newly-appointed Mycologist in Madras to determine the real offender in the latter plant. A careful perusal of Dr. Butler's paper will be instructive to those interested in the subject. It affords an excellent illustration of the extreme care necessary in mycological work, and the many pitfalls which lie in the way of the careless investigator are clearly indicated. But the chief interest in the present Memoir is not confined to this important piece of work. Dr. Butler reviews the various methods hitherto adopted in combating this class of fungus diseases, such as are caused by organisms which are capable of living for long periods in the soil without the presence of their natural host. And he is driven to the conclusion that, where long rotations of other crops are not possible, no direct method can be adopted with any hope of success, and he is fain to place his reliance upon the raising of immune varieties. This is not altogether a new note in mycological research, and work in this direction has already been done on various crops in different countries. Rust in wheat, the potato disease, the diseases of cotton and those of sugar-cane, have for the past ten years or more been thus approached, and the success attained has been sufficiently decisive to show that herein lies an important line for future investigation. Preliminary studies have been commenced with red gram, and Dr Butler is collaborating with the Bombay Agricultural Department in the endeavour to discover new and disease-resistant strains. Little work has as yet been attempted in this direction in India, but it is not improbable that, in their turn, coffee, pepper, tea, and even such long-lived plants as palms and fruit trees will have ultimately to depend upon this line of work for the continuation of their cultivation. Thus far the Mycologist. The carrying out of his proposals lies in the hands of the Economic Botanist,

What are the first steps to be taken in this raising of immune varieties? The answer is given very clearly in the second Memoir before us, Mr. Howard's investigation of the forms of the

NORTH INDIAN TOBACCOS

of the *rustica* type. The first step in investigation of a crop is a careful and scientific study of the forms already existing in the country. The plant breeder must in the first instance collect his material, which is none too easy a task. He must grow the plants collected from all sources side by side for several generations, and note the minutest differences. He must classify and analyse his material, eliminate all accidental hybrids by the application of Men-

del's laws, and reject all such forms as are not perfectly true to seed. The greater the diversity in his raw material, the greater are the possibilities of their improvement....

The sooner the various Agricultural Departments start upon the new road opened up by Mendel's discovery, the sooner will they justify their existence. Not only must they seek to obtain plants with greater cropping powers, greater resistance to drought and so forth, but ever held prominently in view must be their liability to the prevalent disease of the country.

And what is true of fungus diseases is also true of insect pests. These latter are not all due to deficiency of rainfall or other climatic influences, for we know already that certain varieties are less liable to attack than others. Take, for instance, the green bug in coffee. Planters in South India are calling out at the inadequacy of the usual spraying methods recommended. But the coffee plant flowers and fruits fairly early, and it should not be impossible, by suitable crossing experiments, to obtain immune varieties here as elsewhere, and the sooner the task is undertaken the better for all concerned.—*M. Mail*, May 2.

PLOUGHS USED IN COORG.

Mr. L T Harris, Commissioner of Coorg, has sent us the following note compiled by Mr G Haller, Assistant Director of Land Records, on the ploughs in use in Coorg :—Various types of ploughs have been tried in Coorg from time to time but all failed mainly on account of the excessive weight and dearness. What is required is a cheap plough that will last for many years and which is ligbt. The ordinary ryot spends yearly about eight annas for his plough, *i.e.*, the plough itself costs eight annas, and the yoke eight annas, the plough lasts about two years and the yoke three. The length of the plough is 22 inches; and weighs about 9½ lb. The shape of it resembles a boat that has been cut in two. It is five inches at the broadest part and only one inch in the front. The body of the plough is made of wood on which the ploughshare is fastened, consisting of a piece of iron about one foot in length ; the ploughshare is renewed after the first year at a cost of two annas. To the plough the handle and yoke are attached, the length of the former is three feet and four inches, while the yoke consisting of a straight pole is eight feet and four inches in length. To this pole a cross pole is fastened by ropes to which the bullocks are tied. The weight of the handle is 3¼ lb. and that of the pole is 5¼ lb., thus the entire weight is about 18 lb. The plough itself becomes worn out in one season and is used in the following year for the third and subsequent ploughings, *i.e.*, after the soil has been made loose. It is rarely used after the second year. Deep ploughing is not essential in Coorg. The bullocks used for ploughing are about four feet in height, and five feet in length, and are very weak. The fields are in terraces in the greater part of the Province and the ryot is thus obliged to carry his plough from field to field unassisted. It is, therefore, apparent that it is very essential for the plough to be light. Mr Haller will be glad to supply any firm which desires a specimen or photograph of the plough used in Coorg.—*Indian Trade Journal*, April 7.

WEST AFRICAN RUBBER PRODUCTION.

GREAT HOPES FROM HEVEA AND FUNTUMIA.

In a report on the Bordeaux rubber market in 1909, Messrs. Fauches and Channel make a number of interesting observations on the Ivory Coast and its present and future as regards rubber, from which we select the following :—

Two schools of 'monitors' have been at work under the direction of teachnical agents—one at Assikasso, in the eastern part of the Colony, and the other at Bouake, in the west. The natives who have been educated there have become in turn salaried agents, at the disposition of the district commanders, in order to extend in the villages the knowledge required for the good preparation of rubber ; and, in the meantime, the action of these agents has been combined with that of the administrators—station chiefs—who have received special instructions that in all their travels they are to train the natives in the matter of rubber preparation. The application of a programme so methodically conceived must, say the brokers, soon produce excellent results, which will be largely helped forward if the merchants on their part will lend their assistance by applying just principles in their purchases.

The question of production is being very carefully studied. The planting of lianes and trees is being continued everywhere and with regularity. Besides, there are districts still unexploited in the depths of the Côte d'Ivoire forest land, and the production of Funtumia rubber may still be increased, judging by reports that have heen received from the Lieut.-Governor.

According to observations made by M A Chevalier and Capt. Schiffer in their travels over the Côte d'Ivoire, the Funtumia reproduces itself naturally and without care with great ease, thanks to its light seeds and its rapid development. By preserving these reproductions until they arrive at maturity new sources of supply will be available. Besides the Para plantations made in 1898 have prospered so well that the local administration is now engaged in effecting a large plantation of this variety at the station of Agboville on that part of the railway which is already working. The object of this plantation is to encourage colonisation and to put a sufficiently large nursery at the disposition of planters.

With the Hevea and the Funtumia, which prosper well together the Côte d'Ivoire may become, thinks the Lieut.-Governor by reason of its favourable situation one of the principal rubber countries. These data should prove of especial interest to all concerned in rnbber.—*Financier*, March 15.

RUBBER-GROWING AMONG THE NATIVES IN DUTCH S.-E. BORNEO

is going ahead rapidly under official prompting. Government land has been granted to hundreds of natives for that purpose. In the district of Amuntai, there are extensive plantations of Rambong rubber. Several planters, who have been up there, have formulated a scheme for buyi g up this rubber from the growers and for working it up on the spot. Native rubber growers have ordered large quantities of rubber seedlings from Singapore.-*Straits Times*, April 15.

CHEMICAL SPRAYS FOR WEED, INSECT, ETC., DESTRUCTION.

We have received a very neatly drawn up circular from the Acme Chemical Co., Limited, Tonbridge, Kent, giving a general idea of the methods they recommend for the destruction of weeds, insects, and fungi. They submit that the only effective method of ridding land of weeds, especially Lalang Grass, is to attack the roots with a solution of Arsenite of Soda. Where the roots are not more than a foot below the surface, and the soil is fairly loose, the solution will find its way to the roots if the ground is well and carefully sprayed. If tho grasses and weeds have been cut down and removed, and the surface so cleared that there will be no waste of solution upon the rubbish lying about, a good dressing at the rato of 25 gallons to 70 or 80 square yards (that is 80 by 1) will be sufficient to kill the roots without taking them up; the time choson for application is when the ground is moist with dew. The ground should be well sprayed once, and then again before it has time to dry, one dressing following the other whilst the ground is wet. If the roots are more than a foot down it may be necessary to fork them up or to loosen the ground so that the solution can easily penetrate to them. It is stated that to destroy young Lalang by forking costs at least about $30 per acre, whereas the cost of Arsenite of Soda of sufficient strength to accomplish this more effectually upon an acre of ground would only cost about $13 (1 dollar=2s. 4d.) c.i.f. Port Swettenham, Singapore or Penang. The time occupied in spraying the solution over an acre would take three men, with a fairly good distributing apparatus, from three to four hours. There may be cases where from the nature of tho ground, or the fact that the Lalang is so deeply rooted that it has to be dug up and the roots taken away and destroyed, but even in such cases many broken pieces of root are bound to be scattered over the surface. These will grow again if not destroyed. One spraying would be sufficient to destroy these pieces of broken roots, thereby using just half the quantity of solution.

Ants or any other vermin feeding on vegetable matter in the soil would also be destroyed.

Another preparation manufactured by the Acme Chemical Co., Ltd., is "Fumerite" a non-poisonous preparation which when mixed with the soil gives off a gas most deadly to insects and especially to ants. The fumes permeate the soil for a considerable distance around if the surface is beaten down fairly close after the powder has been put in the earth. The fact that white ants work in tunnels makes this powder very effective against these insects. The fumes collect in the galleries and complet-ly exterminate the insects. If tho powder is put near the roots without actually touching them the fumes will travel through the soil without doing harm; ants and other insects living in the soil or among the roots are nevertheless killed. Its action is very quick in warm and moist soils, and for a long time it will continue to be very objectionable to insects. In the course of a couple of months it will become exhausted, but the residue is a good plant food. They strongly recommend its use against the attack of ants on young plantations, and they give full instructions in the circular how to use it both in young plantations and in older plantations. This powder is mixed with from 100 to 200 parts of soil, and is very cheap.

"Anti-Fungi Powder" is a non-poisonous powder cotaining the active properties of the Bordeaux Mixture; it does not scorch or injure foliage. In many situations where it is difficult to use liquid fungicides this powder is most useful, and in any case it is cheaper to use than the liquid. It has been used with good effect against fungoid diseases on Hops, Tomatoes, etc.

"Arsenate of Lead Paste" is a poisonous preparation which destroys all biting and leaf-eating insects, such as caterpillars and beetles. It may be mixed with Bordeaux Mixturo or Solution of Sulphate of Copper, and so act as an insecticide and fungicide. Of all arsenical washes Arsenate of Lead is best to use because of its being more easily mixed. It is held in suspension much longer than Paris Green, and the scorching noticeable after using Paris Green never occurs when Arsenate of Lead is used. It also adhores to leaves better than most washes. 1 lb. is sufficient for 25 gallons of water, and as it is only necessary to slightly wet the leaves it is an economical wash. On cotton plantations it has been customary to use quantities of Paris Green Powder, but owing to the uncertain effect of Paris Green, its scorching of the foliage, and danger to natives inhaling the poisonous dust, Arsenate of Lead Paste, in solution, is quickly taking its place.

The Acme Chemical Co., Ltd., manufacture chemicals for agricultural and horticultural use, and are specialists in insecticides, fungicides, etc.

We hear that a copy of this circular has been sent to all rubber plantations, and if planters will write them explaining any difficulties, they will be happy to give them the benefit of their many years' experience in combating the attacks of insects, diseases of plants, and destruction of weeds.

If spraying machines or powder distributing machines are required, on being supplied with particulars of the work the machines are to accomplish, the nature of the ground over which they have to work, etc., they will be glad to send particulars and quotations.

THE UTILITY OF CHALK.

BY MR. JOHN HUGHES.

AGRICULTURAL ANALYST FOR HEREFORDSHIRE.

The value of freshly burned lime for agricultural purposes has been recognised from a very remote period, also the utility of the application of chalk, which consists of lime combined with carbonic acid, has also been recognised by practical farmers. But the conditions of soil and climate which should determine respectively when the highly caustic or quick lime, and when the mildly caustic chalk should be applied have not been recognised as they should be. In the first place quick lime when properly burned and

slaked with water is not only highly caustic in its action, but, compared with chalk, being readily soluble in water, exerts a strong caustic or burning action upon the humus or vegetable matter that may exist in the soil, so that it not only neutralises any acidity existing in the soil, but it positively burns up and converts the valuable hygroscopic vegetable matter into carbonic acid, which subsequently unites with the lime, forming carbonate of lime. Quicklime, therefore, may be used with advantage on soils that contain an excessive amount of vegetablo matter, because such matter in its acid state as it exists in damp mooriand pastures, is really injurious to healthy vegetation, and the formation of nitrates ; but on many soils such as granite, gravel, and sandy soils, the application of the highly caustic quicklimo is calculated to do more harm than good, becauso these soils, though deficient in lime, are usually also deficient in vegetable matter. Bayldon in his book on the valuation of rents and tillages states that on no point in agriculture does more vaguo uncertainty prevail than on the use of limo. No inference has been drawn either from practice or science to guide the farmer with certainty in applying lime to the land ; in fact, it is applied often by the caprice or individual judgmont of the farmer without any certain knowledge of the result that will be produced. On light soils of all kinds, he states, the benefit of lime is very doubtful. The above represents the opinion of an experienced valuer in 1864. At the present time there is a strong opinion gaining ground among practical men that the use of lime in moderate quantity is necessary to counteract the injurious effect produced by the continued application of acid manures on soils naturally deficient in lime, for acid manures certainly tend to remove the available lime as proved by the Woburn experiments. Indeed the great success of the application of phosphates in an alkaline form such a basic slag and the more recently introduced basic superphosphate has afforded a practical illustration of the great benefit which has resulted from the use of the above manures on certain kinds of soil; the question to be decided is the particular form in which lime can be most efficiently employed. In considering the relative suitability of a fertiliser it is usual to assume that the availability is dependent upon the solubility in water and in weak solutions of a vegetable acid like citric acid.

Relative Solubility in Water.

Caustic lime is more soluble in cold than in boiling water, while chalk is only very slightly soluble in cold distilled water. According to to my experiments the actual figures are as follows :—

1 part caustic lime dissolves in 833 parts of water.

1 part chalk dissolves in 22,222 parts of water.

It will be soon how very much more soluble caustic lime is compared with carbonate of lime in the form of chalk. But the ordinary soil water contains vegetable acids such as carbonic, ulmic, and humic acids, which exert a powerful solvent action on the various soil ingredients that constitute the natural food which tho roots of plants aidod by the acid sap contained therein absorb from the soil by osmotic action. Consequently it is not the solvent action of pure cold distilled water that should be considered, but rather the action of soil water impregnated with vegetable matter. It is therefore very natural that some vegetable acid solution should be selected as a standard solution. In Germany, Professor Wagner has suggested a 2 per cent. solution of citric acid as a standard solvent for estimating the probable availability of phosphate of lime in basic slag. In this country Dr Bernard Dyer has suggested a weaker solution of only 1 per cent citric acid, while I in 1901 suggested a still weaker solution, namely, 10 per cent. solution, consisting of 1 part citric acid dissolved in 1,000 parts of cold water, which represents an acidity absolutely less than that possessed by the sap of any farm crops, so that any lime, phosphoric acid, or potash dissolved by such a solution may fairly be regarded as existing in a form available for plant food. When caustic lime and chalk finely ground are exhausted with this solution the following results were obtained :—

Relative solubility in. 10 citric acid solution

1 part caustic lime dissolves in 809 parts solution.
1 part chalk dissolves in 984 parts solution.

As 1 part of carbonate of lime in the form of chalk consists of 56 lime and 44 carbonic acid, it follows that 56 lime existing in the 1 part of chalk is dissolved by the above 984 parts of water, which is equivalent to 1 part of lime in the form of chalk being dissolved by 1,758 parts of this 10 solution of citric acid. From these figures it appears that in pure cold water caustic lime is about 27 times more soluble than chalk, but that in the weak 10 citric acid solution lime as caustic lime is only about twice as soluble as lime in the form of chalk. Consequently if chalk be reduced by grinding to the same state of fineness as caustic lime it will be sufficient if one ton of such ground chalk be applied per acre instead of 10 cwt. of ground lime. In addition to the convenience of the application of chalk instead of the irritating caustic lime there is the less cost to be considered.

Rough chalk can in many districts be obtainod at 3s to 4s a ton rail as against lime at 12s to 15s per ton. Further, the mild chalk while supplying the lime necessary for bacterial action in the soil does not burn up and consumo tho vegetable matter which is so valuable as a plant food and also for the retention of moisture. Indeed, the agricultural utility of chalk on all light soils has hitherto been sadly neglected, and the heavy dressings sometimes applied were very costly and quite unnecossary. Chalk should be dried and ground into a fine powder, then applied on the surface, followed by a light harrowing in order to effect the necessary mixing with the soil, so that it may be rendered soluble by the soil water, and the sap acidity of the rootlets of the subsequent crop.

The red soils of Herefordshire and Worcestershire furnish good illustrations of the kind of land that would be improved by dressings of finely ground chalk. But all light land such

as gravel, granite, and sandy soils, which are usually deficient in vegetable matter, and at the same time deficient in lime, will be greatly enriched in fertility by the application of a ton of finely ground chalk per acre.

BASIC SUPERPHOSPHATE.

The reasons why a solution of ·10 per cent. Citric Acid (1 to 1,000) was selected as a standard solvent. Also particulars of the process of analysis employed.

SELECTION OF A STANDARD SOLVENT.

It is generally recognised that plants derive their mineral food by absorption in a liquid state through their root hairs; solid particles, however small, being incapable of passing through the membrane of the root hairs. The absorption of food is in fact a process of dialysis, the acid solvent or sap being inside the root, and the plant food being in the soil on the outside. This dialytic action can only proceed when there is a sufficient supply of moisture on both sides of the intervening membrane. Hence during a drought, as the soil moisture becomes dried up, the flow of the root-sap through the intervening membrane is checked, and the plant droops and perhaps dies from want of nourishment. How to imitate the natural action of the root sap upon manurial materials, or upon the store of available food in the soil, and to evolve a standard solution which when used in definite proportions, would indicate the extent to which manurial materials, either directly applied or existing naturally in the soil, would become available as plant food, is a problem which has hitherto puzzled Agricultural Chemists. In selecting a standard solution, it seems very natural that some vegetable acid should be adopted. In Germany, Dr. Paul Wagner, of the Darmstadt Agricultural Station has suggested and for some years employed, a 2 per cent. solution of Citric Acid, namely two parts of Crystallised Citric Acid dissolved in a 100 parts of cold distilled water. He takes one part of manure and 100 parts of such solution and mechanically agitates in a bottle for half-an-hour and then filters off the liquid and determines the proportions of plant food dissolved. In this country, Dr. Bernard Dyer, after a long and laborious examination of the acidity of the sap in 103 different plants, arrived at the conclusion that the average acidity of the sap might be represented by a 1 per cent. solution of Citric Acid, and that a solution of that strength might fairly be employed in the determination of the proportions of available plant food either in a soil or manure. In arriving at this conclusion, he appears to have overlooked the fact that out of the 103 plants examined, no less than 16 specimens, representing the *principal* farm crops, such as Wheat, Barley, Oats, Turnips Swedes, Mangolds and numerous grasses, yielded an average sap acidity of less than ·50 per cent. Further, that the original acidity of the sap must become greatly diluted by contact with the moisture associated with each particle of soil. In devising, therefore, a standard solvent, the writer has preferred to employ a solution of less acidity, but in greater volume, because in nature the solutions are very weak, while the volume of water in the soil is very large. Thus, an inch of rain represents in round numbers 100 tons of water (224,000 lb.) per acre, which at 30 inches per annum represents 6,720,000 lb. a year. If, therefore, 5 cwt. (560 lb.) of Basic Super be applied per acre, it will, under ordinary circumstances, be exhausted by no less than 6,720,000 lb. of water, or a proportion of 1 part solid to 12,000 parts liquid. For these reasons then, a solution of .10 per cent., namely, 1 part of Citric Acid to 1,000 parts cold distilled water, has been selected as the standard solvent, and to be employed for exhausting manures, in the proportion of 1 part of manure to a 1,000 parts of this solution (or similar proportions), 24 hours being allowed for the exhaustion. This solution is 20 times weaker than that of Dr. Wagner, and 10 times weaker than that of Dr. Dyer, and represents an acidity absolutely below that found in the sap of any of the 103 plants examined by Dr. Dyer. Consequently, it may fairly be claimed that all phosphate of lime that is dissolved by such a weak solution, representing only 10 per cent of Citric Acid, may be safely regarded as being in a condition readily available as plant food.

PARTICULARS OF THE PROCESS OF ANALYSIS.

The manure must be ground into a fine powder and 1 gramme placed in a large beaker, or bottle, to which 1 gramme of Citric Acid and 1,000 cc of cold distilled water are added. It is desirable to weigh out the materials in the morning in order to allow occasional stirring or shaking during the day, for after standing all night, the solution having had a final agitation next morning is to be filtered off. The filtrate is then concentrated to about one-fourth the original volume, the lime removed and the phospheric acid determined in the usual way by the magnesia process. The matters insoluble in the solution having been collected on a filter are ignited and weighed, thus obtaining the proportion of mineral matters insoluble in the standard solution.—JOHN HUGHES, F.I.C., Agricultural Analyst, 79, Mark Lane, London, E.C.

RUBBER IN SOUTH INDIA.

REPORT ON A TOUR IN COCHIN AND TRAVANCORE.

(*By Rudolph D Anstead, Planting Expert.*)

Leaving Bangalore on January 24th I started on a tour in South Travancore and Cochin, and visited a number of Rubber estates, and also some Tea estates in the hills of S. Travancore. I attended a Planters' Association meeting at Quilon on January 29th and gave a short address dealing with the more important local agricultural matters. On February 15th I left Cochin and returned to Bangalore, proceeding a few days later to South Mysore to conduct some experiments in the cross-fertilisation of hybrid coffee. On March 24th I resumed my tour and visited the Mundakayam district and saw a number of the Rubber estates there. On April 2nd I attended a meeting of the Mundakayam Planters' Association and lectured on the diseases of rubber and important points connected with its cultivation. Leaving the next day, I proceeded to Peermade and Central Travancore and made a tour of the Tea estates, ending by

attending a meeting of the Central Travancore Planters' Association on April 9th and lecturing upon the treatment of *Helopeltis* and manuring of Tea. I finally returned to Bangalore on April 13th.

RUBBER.

Without making any distinctions between one estate and another, or one district and another, I may say that I was very much struck by the appearance of the para rubber throughout the whole of my tour and can congratulate the planters as a whole on its excellent prospects. I had the pleasure of visiting the far-famed Palapilly estate, without doubt a most successful piece of rubber cultivation in every way.

DISEASES.—As is the case with all cultivations of one plant on a large scale and over a large area, diseases are present. This is to be expected indeed it would be a very, remarkable thing were it not the case. Both "Pink disease" and "Die Back" occur and cause an amount of trouble which varies from place to place. Both diseases are to be found on several indigenous trees in the surrounding jungle and spores are constantly carried from the jungle to the rubber, which accounts for the annual recurrence of the disease on the rubber. There is, however, no cause for special anxiety. Planters know all about these diseases, and are taking every precaution and there is no reason to suppose that they will ever be allowed to assume the proportions of an epidemic. Every care should be taken to tackle the disease directly it appears, and a constant watch should be kept for its first appearance. This, in fact, is being done throughout the district. Of the two, the "die back' is probably the more important and the more to be feared, especially if it is neglected. Quite recently two Circulars (Vol. iv. Nos. 21 and 23) have been published by the Royal Botanic Gardens, Ceylon, written by Mr T Petch, the Government Mycologist, dealing at length with the "pink fungus" and the "die back," and I cannot do better than quote Mr Petch's excellent descriptions of the two diseases. At the same time I advise every planter interested in rubber to obtain these most interesting circulars, and "read, mark, learn, and inwardly digest" every word of them even down to the scientific names of the fungi producing the diseases. . . . . The disease is always apparent soon after the monsoon has begun. In the dry season the spores are present, lying dormant on the trees in convenient places such as the forks of the branches, which is a very common point of attack, waiting only for the rain to supply them with sufficient moisture to start them into growth. This suggests the possibility of a preventive method of control. Copper sulphate is a well known fungicide, and its presence kills growing fungi. If then during the dry weather the trees can be coated with this fungicide, when the rain comes the spores will germinate in its presence and be killed. The spores are blown about in the dry season, and the fungus grows during the Monsoon, the production of spores being its final stage at the beginning of the following dry season ready for redistribution. Presumably then there are few or no spores being carried about in the monsoon and if those in *itu* are killed by copper sulphate as they germinate, the rubber should be free from the disease for a year. This is the method "on paper." In practice it needs an experimental trial, and at Palapillay it is uudergoing this trial. Every tree was, during the dry weather, painted as far as it could be reached with Bordeaux Mixture made up with gum to make it stick. I am informed that the work was not difficult; and the cost was small. The result as far as the protection of the trees from disease is concerned will not, of course, be known until after the monsoon. I hope at a later date, with the permission of Mr Nicoll, to publish fuller information about this method and its results. The disease appears to attack trees from two to five years old more than older trees. When it is found, the affected part should be cut out. In the case of quite young trees they should be cut back well below the affected part. On old trees the diseased part should be cut out, and carefully collected and burned. The wound should then be tarred, care being taken to apply the tar to the cut and not to spread it over the bark A still better plan would be to wash the wound first with Bordeaux Mixture and to tar it afterwards. A watch should be kept on all treated places to see that the new bark is healing up properly, and that all traces of the fungus have been removed. If this work is consistently done and a watch kept, especially at the beginning of the wet weather, for the first appearance of the disease, there is no reason to fear the disease.

It would be interesting to know exactly what trees in the jungle are attacked by *Corticium Javanicum*, and, these being known, it would obviously be an advantage to eliminate them if possible from the borders of the estates.

RUDOLPH D. ANSTEAD, Planting Expert.
—*Planters' Chronicle*, April 30.

RUBBER CULTIVATION IN SPANISH POSSESSIONS IN GULF OF GUINEA.

The following information is from the report on the trade of the Spanish Possessions in the Gulf of Guinea in 1909, which will shortly be issued :—There is said to be a plentiful supply of vine rubber in the districts of Bata and Elobey on the mainland. Trade in this article fell off during 1908, owing to the fall in prices in Europe; during 1909 it improved, but was affected adversely by the prohibition of the sale of guns and powder, for which there is a great demand amongst the natives.

The planting of Para rubber is being taken up in the Island of Fernando Po, one firm having about 3,000 trees growing well, of which about 500 have been raised from Ceylon seed and 2,500 from local seed. The larger trees, which are seven years old, have been tapped, but only to ascertain the flow of latex, which is said to be greater than from trees in the gardens at Victoria, in the Cameroons. Another firm has about 500 trees from seed obtained from plantations in the Eket district, Eastern province, Southern Nigeria. The climate and soil of Fernando Po appear to be generally suitable for the cultivation of Para rubber.—*Board of Trade Journal*, March 31.

CHINA TEA IN 1909.

A GLANCE AT THE SEASON.

Another season passes into review, and 1909 goes down to history as a year that on the whole has been favourable, both for black and green descriptions, alike to the native manufacturer and to the foreign shipper. There may have been, of course, as there generally are in most seasons, times when business has actually been unprofitable for both parties, but taking the bitter and the sweet together final results have been on the right side, though possibly in a more modified degree than was at one time anticipated. The quality of the black tea crop all round may be correctly stated to have been "quite good"; particularly was this the case with Keemuns and Oanfas, For a short time after the opening of the Hankow market on May 11, Russian buyers seemingly had absolute control over the arrivals of the first-named teas and paid fancy prices for fancied Keemuns—Tls, 70 to 75 per picul—which intrinsically were not worth more than the later purchases at Tls. 50 to 55. But prices all round for Keemuns must have yielded a golden harvest to tea-men, while the teas themselves fully proved in results that they were worth the money paid for them. These teas were brisk and strong and pre-eminently commanded the attention of the home trade. Regarding the quality of the Ningchows there were certain differences of opinion, some expert buyers affirming them to have been quite as good teas as for some years past; others that they possessed more strength than usual, and again others declaring them to be thin and insipid, a view shared in by the native. These teas were approved of in Russia, but though the average buying price was a fairly reasonable one, the teas did not "catch on" in the home markets.

For Hankow teas prices ruled throughout considerably below the currencies of 1908, and notably was this the case with the commoner grades, which averaged all round some twenty per cent lower prices than in the previous year. The quotations are worth repeating, if only to warn intending operators that, if exceeded, there can be no repetition of 1909. First crop Shuntams Tls. 9 to 11 per picul, Kokews Tls. 10 to 11, Lylings Tls. 11 to 12, and sweet Otopacks at Tls. 12 to 14 per picul. How cheap these teas were does not appear to have been recognised at the time they were offered; in fact they hung fire, but they were subsequently bought in the Shanghai market by those who failed to appreciate their value, at an advance of 20 per cent to 25 per cent, that is, that common teas which were literally going a-bogging in Hankow in July and August at Tls. 9 to 12, in many cases realised Tls. 14 to 17 in Shanghai in October and November. And even at those enhanced prices these common teas did not lose money to ultimate shippers.

Regarding these teas it may not be out of place to restate what was written of them in these columns last May — "The good cup quality of the crop is bound to be recognised, but it is matter for regret that their stalkiness and dustiness are not unlikely to prejudice the value of common teas for blending purposes." From what we know these conditions kept home currencies to the low level of cents 4 to $4\frac{3}{4}$ per lb, though these teas were by no manner of means in over-supply.

THE YEAR'S EXPORT.

The total export from North China of black teas this season is the lowest for the past four years, as indicated by the following figures:—

		1906	1907
Russia	...	32,250,000	36,120,000
U.S. and Canada	..	6,100,000	5,500,000
United Kingdom	...	4,800,000	8,500,000
Continent of Europe	..	2,300,000	3,300,000
		45,450,000	53,420,000
		1908	1909
Russia	...	34,350,000	28,000,000
U.S. and Canada	..	13,300,000	6,600,000
United Kingdom	..	7,400,000	6,400,000
Continent of Europe	..	3,500,000	3,000,000
		58,550,000	44,000,000

The position of China Congous in the several markets of the world is, at the moment, exceedingly favourable. It is up to buyers next month to gang warily, and not spoil the horn in their endeavour to make a spoon.

Though no snow fell in this neighbourhood during the Chinese New Year holidays, yet the country of the tea district is said to have been sufficiently visited, and native advices are to the effect that a crop of good quality may not unreasonably be expected.

TEA MARKING.

Incidentally attention may be drawn to the anomaly of marking tea chests with a double season. In the old factory days at Canton, when teas were not brought in to market until the fall of the year, and shipped off by sailing vessels in the winter months, it was reasonable to mark teas in that manner; but now-a-days when the whole crop goes forward in the year of its production the practice is generally maintained, and uselessly.

IMPROVEMENTS IN CULTURE.

It is gratifying to be able to record the fact that steps are being taken with a view to the improvement of China black teas generally, and that the first move will be an attempt to regain in some measure for Ningchow teas the quality and popularity which for long years they enjoyed. Towards this desirable end a

MEMORANDUM HAS BEEN SUBMITTED BY AN INFLUENTIAL TEA HONG TO THE MINISTRY OF AGRICULTURE,

Industry and Commerce at Pekin, pointing out the difficulty of securing a combination of tea hongs, tea dealers and tea growers, and suggesting that the Viceroy and the Governor of Kiangsi may be instructed to advance Tls. 30,000 or Tls. 40,000 to begin with for the supply to growers of bean-cake, ground nuts and vegetable refuse for manuring purposes. This has special reference to the Yiningchou district, where it is pointed out that supplies of the article have declined from 200,000 half-chests to 60,000 half-chests, entirely owing to the fact that the natives have neglected to clean the ground, turn it over and fertilise it. Keemun is pointed to as an object lesson, for,

as is well-known, Keemhn teas have attained and still maintain their popularity simply owing to the fact that untiring attention is paid to these matters, and that as a consequence the production of this district has increased from 20,000 half-chests a few years ago to 95,000 half-chests last year, and that the probability is that considerably over 100,000 half-chests will be sent to the market at Hankow this season. The memorandum points out that while Indian teas are stronger, are protected by Government and are free of duties, yet with the abolition of likin, stricter attention to culture and manufacture, China teas could certainly be made stronger than at present; while they will always have that "sweet fragrance" from being sun-dried, which teas prepared by machinory never can possess. It admits that Indian tea owes its present pre-eminent position to widespread advertising, as well as to its incessant, almost unscrupulous, exposure of the "alleged impurity" of China teas; and it urges the Ministry and the high authorities to take immediate steps in conjunction with merchants "so that the trade may be recovered and extended." There is a touch of sarcasm as to the methods adopted by the China Association and a bit of sound common sense in the following excerpt:—"The attempt of certain foreign tea firms to eulogise Chinese teas by means of the press (obtaining cheap press notices rather than advertising) and lectures has not met with any noticeable success and unless the teas are radically improved no amount of public praise will help," which may be construed to read: "Improve the tea first, and make it worthy of all advertisement afterwards.'

The memorandum concludes by pointing out the risks incurred through the absence of proper storage for teas which, in the case of Hankow teas particularly, are stowed away in junks and subject to the vicissitudes of the Han river, bad weather, squeezes and inability to deliver tea sold as readily as could be wished, and prays the Ministry for a loan for the building of a godown capable of storing, at least '200,000 half-chests of tea.' Such accommodation would be beneficial to native and foreigner alike. It would enable the native to deliver his produce in better order, as also to finance it more easily, while it would certainly benefit the foreigner if it but contributed to retard the present rushed export, the prime cause of much trouble. It would enable him to give a little more time to inspection and to ship off his purchases more at his leisure.

No official reply has as yet been received to his memorandum, but the wind blows that it is receiving attention.

It is pleasing to note that small experiments with artificial manure are to be made this year.

Another proposal has been made by an important native authority in which there is show of reason, that a combination should be made for the purpose of leasing a certain area of tea land, which should be planted out, manured and kept clean, and the plants given what they lack now, a sufficiency of space, light and air; that these teas should be specially sold as being from a certain district, and by no chance mixed with the leaf of contiguous gardens. Doubtless this would entail an initial expense to teamen, but they appear to be hopeful that all in the end would benefit.

The green tea season of 1909 establishes a record in the shortness of its duration. First arrivals came to hand from the Hoochou districts on June 15, and the market opened on June 17, with purchases at Tls. 29½ per picul; or 3 per cent higher than last year. These teas are little else than Pingsueys in disguise. Their chief points of difference are that they bear a different name and are packed in half-chests and not in boxes. When the supply of Hoochous is excessive it is sometimes found necessary, in order to effect a sale, to repack the teas into boxes. This happened during the past season when 12 per cent of the crop or over 3,000 half-chests were so repacked.

The opening prices of Pingsueys were really the lowest of the season. Later on quotations had risen 10 to 15 per cent. for first crop leaf. The second crop was poor and disappointing and of the third crop amounting to some 30,000 half-chests of highly faced rubbish over 80 per cent was unfit to pass the American standard and so it was that thousands of packages of the meretricious article were precluded entry into the States, and were shipped off only to swell London stocks. The early arrivals of Wenchow teas were of capital cup quality and the first few chops bought were amongst the cheapest purchases of any green teas during the season. Shanghai packets likewise were rather above the average for a month or two, but later on they fell off markedly in both cup and make. Supplies of both these descriptions are on the increase and promise to be heavier. The advantage these teas present to the continental buyer is the ease with which he can secure any special line for which he may have orders.

It was hardly to be expected that the heavy supplies of Hyson which came to hand in 1908 (about 190,000 cases) would be maintained, but the trade is a big one, about as large as that of the whole of the country teas put together. The fluctuations in prices are very heavy, often Tls. 15 to 30 a picul, but the business must pay teamen handsomely.

Every season has its special features. The two that stood out in boldest relief this last season were the rush there was for the most audacious faked common Pingsueys, the ease with which those rushes were met, the extravagant prices demanded and without the least delay or difficulty obtained. And this too, when it is remembered that the American standard for Pingsueys is a first crop tea. Is it to be wondered at that the brown infusions of the third crop teas caught the keen eye of the inspector and that the teas were refused admission? In the circumstances shippers stand to be shot at with their eyes open.

The second feature was the absurd range of prices established for choice Moyunes and more than maintained for the second and third chops. Many of these teas are still unsold in New York.

The lines to all concerned in the production of green teas this year must indeed have fallen in "pleasant places."

The following particulars of sources of supply have their interest :—

	1907.	1908.	1909.
	(For half chests.		
Moyunes ..	67,000	58,000	55,000
Tienkais ..	52,000	44,000	54,000
Fychows ..	26,000	39,000	49,000
Country teas ..	145,000	141,000	158,000
Hysons ..	123,000	188,000	138,000
Pingsueys ..	161,000	145,000	142,000
Hoochous ..	13,000	16,000	27,000
Wenchows and Shanghai packed ..	32,000	34,000	37,000
	474,000	524,000	502,000

The export figures read as follows :—

	1907.	1908.	1909.
United Kingdom	2,750,000	1,800,000	1,300,000
Continent of Europe	2,700,000	5,000,000	6,500,000
United States	16,400,000	13,750,000	15,400,000
Canada	575,000	1,000,000	1,100,000
Batoum	9,000,000	13,000,000	10,000,000
Bombay	1,000,000	1,500,000	1,200,000
North Africa	375,000	590,000	865,000
	32 800,000	36,640,000	36,365,000

Noticeable features in the above figures are the rapidly expanding trades with the European Continent and North Africa. Hamburg's big business is in Sowmees, to cost c.i.f. 4d or under, not a high standard.—The vagaries of the stocks of green tea in London are really remarkable and the following figures, if correct, will create surprise :—

	lb.
The stock of Green Tea in London on July 31st, 1909 was ..	1,300,000
The total export of Green Tea to London for season was ..	1,300,000
	2,600,000
The delivery for eight months August to March inclusive ..	3,820,000
Showing an excess over deliveries of stock to be ..	1,2 0,000
But the stock in London on March 31st, 1910 was ..	3,300,000
Which shows that supplies from other sources must have amounted to no less than ..	4,520,000

That is, that the indirect import into London is three-and-a-half times as large as the direct export from China.

It is well known that large quantities of tea find their way from Hamburg and Marseilles into London, as also the quantity was never exhibited in this way before. It would, indeed, be interesting to know with some exactness, the contributing proportion from each and every source.—*North China Herald*, April 15.

RECORD RUBBER GROWTH IN THE PHILIPPINES.

It is reported from Davao that on the plantation at Lais, managed by H S Peabody, 100 Castilloa rubber trees, three years old, were measured (without selection of trees) and the measurements 3 feet above the ground ranged from 22 to 34 inches in circumference. These trees are bearing seed. From reports it appears that these trees equal in size the rubber trees of Ceylon which are from 5 to 7 years old.—*Mindanao Herald*, April 16.

SOCIETY OF CHEMICAL INDUSTRY.

LONDON SECTION : LECTURE ON RUBBER.

Mr. H. K. Rutherford and Mr. H. Wright Speak.

A meeting of this section was held at Burlington House, Piccadilly, W., on April 4th, Dr. J Lewkowitsch in the chair. A paper was read by Dr. P Schidrowitz on

THE INDIARUBBER INDUSTRY.

The lecturer first briefly sketched the origin of the rubber industry, the founders being Hancock, Mackintosh, and Goodyear. Peal, in 1791, was granted a patent for the application of caoutchouc to waterproofing cloth ; in 1820 Hancock devised a "masticator" for working up rubber into a homogeneous mass, and Mackintosh was the first to use a solution of rubber for waterproofing purposes. Goodyear, in 1839, discovered the use of sulpher for vulcanising rubber, a precess which Hancock independently discovered in 1844. The lecturer omphasised the importance of vulcanising, which renders rubber proof against temperature and atmospheric action......The rubber industry consists, said Dr. Schidrowitz, of a series of industries : (1) The preparation of the crude rubber ; (2) manufacture of rubber articles ; and (3) working up of waste rubber. The influence of the planting industry has made itself felt in the improved methods of preparing the crude rubber so that the old territorial classifications in grading are giving way to a system based on the botanical origin. A series of lantern-slides was then shown to illustrate the method of obtaining the latex of the rubber-trees and methods of preparing rubber from it. The sources of rubber were thus classified :—

—	Indigenous.	Planted.
Hevea braziliensis	Amazon	Malay, Ceylon, Java, Sumatra, Samoa,
Ficus elastica	Assam, Malay and East generally	Dutch colonies, New Guinea, etc.
Funtumia elastica } Landolphia species }	Tropical and subtropical Africa	Uganda, Cameroons, etc.
Castilloa elastica	Mexico and Central America	Mexico, West Indies
Manihot Glazcovii	Brazil	The East, Cameroons

The acreage of planted rubber was put as 693,000 acres, of which 250,000 are in the Malay Peninsula and 190,000 in Ceylon. The chemical differences between rubber from the various species is surprisingly small when allowances have been made for the various methods of obtaining and treating tho latex. The plantation industry has so developed that it has been shown that it is possible to prepare all qualities of high-class rubber. The physical differences are more marked, but these may disappear when more is known of the conditions of preparation. The bulk of the rubber is still made by haphazard methods, and loses much in washing. The amount of resin present is influenced by the mothod of proparation. Para rubber still sets the standard, but does not fetch the highest price

owing to the proportion lost on washing. After touching on the influence of age on the trees and discussing the question of yield, the lecturer quoted some figures by Mr H K Rutherford for an estate in Malay, where 100 to 200 lb. of rubbor per acre is being produced at a cost of 10·74d, to which should be added 3·3d for freight, packages, etc., and an amount varying from 1d to 2d per lb. for interest on capital. After noting that the method of coagulating the latex is by adding acetic acid, tho lecturer enumerated the varieties of ruhber that are made, crêpe, and sheet being the chief. The trying is sometimes carried out in a vacuum drier, but tho results vary according to the care with which the drier is employed. Tho discovery that an enzyme present in the *Hevea* latox is destroyed at 183° Fahr. has been utilised to the advantage of the resulting rubber. The lecturer next referred to probable changes in the mothods of preparing crude rubber, the improvement of the means employed for wild rubber, and the preparation of good rubber from low-grade resinous rubber by chemical process. Synthetic rubber then claimed attention, the subject being reviewed from Tilden's isoprene method to Harries's recently published work. The matter resolves itself into a competition between chemists and Nature, the latter producing rubber which can be put on the market at 1s a lb. This is a very large proposition, considering the cost of the materials from which the chemist starts. The analogy of indigo is a misloading one, as indigo only exists in a dilute form in the plant and costs about 3s 6d per lb. The manufacture of rubber goods was next described, and the methods of vulcanising with sulphur and sulphur chloride were dealt with in detail. The recovery of waste rubber by various processes was considered and the new 'reforming' process described. The last-named consists in grinding the waste rubber to powder, heating and causing the rubber to cohere by great pressure.

Discussion.

The Chairman—opened the discussion. He said the problem of preparing synthetic rubber is similar to that of making artificial camphor, and referred to Harries and Bayer processes recently patented for synthetic rubber. An electrolytic, method of coagulating rubber has been recently introduced. Sir George Watt referred to his official duties as botanical expert to the Indian Government. Mr. H. K. Rutherford created some amusement by his candid warning about taking the advice of experts, giving several instances where the experts have been wrong. Mr. H. Wright pointedly asked whether Harries's work marked any advance of commercial importance. He placed the yield per acre at 300 lb., this estimate being based on recent experience. There are today 720,000 acres of rubber plantations in the East, and the British lead the way in the industry. Mr Hammond Smith spoke of the need for quick drying in the wet climates where rubber flourishes. He looked to the School of Tropical Medicine for help in enabling white men to live healthily in West Africa and so be able to supervise the rubber industry in that country. Colonel Burley, as an expert on recovering rubber, said he wanted rubber with the minimum of resin. Mr F L Ross, engineer to the Re-formed Rubber Co., described the process used by his company. He hoped to be able to supply rubber tiles at 1*l* per square yard: this would be an ideal floor covering of practically everlasting wear. Mr W F Reid dealt with the question of recovering rubber and of devulcani, sation by means of inert selective solvents Rubber need not be used for waterproofing purposes, a substitute should be found, as the rubber is, he considered, unsatisfactory from the wearer's point of view. Other speakers were Mr Bevan, Dr. Stephens, Dr. Phillips, Mr H C T Gardner and Mr A C Chapman, after which Dr. Schidrowitz replied. Harries's work was not, in his opinion, of commercial importance, and he considered that chemist most unfair in his trertment of Dr Tilden's paevious work.—*Chemist and Druggist*, April 9.

THE RUBBER INDUSTRY OF JAPAN.

H. M. Commercial Attaché at Yokohama (Mr. E F Crowe) has forwarded the following particulars relative to tho use of various products of rubber in Japan :—

The subjoined statement of the imports of crude rubber during the past four years shows how rapid has been the development in the rubber trade :—

		Quantity, lb.	Value. £
1906	...	606,728	59,[illegible]00
1907	..	693,125	7[illegible],600
1908	...	1,039,430	90,500
1909	..	1,331,826	150,000

In the closing months of 1909 there was a sudden development in Tokio and Yokohama of the use of solid rubber tyres for jinrikishas, and there is little doubt but that the fashion will spread to nearly all the large towns in the provincos, The price naturally varies considerably according to the quality, but it appears that a pair of wheels with tyres costs from 26 yen to 34 yen (yen = 2*s.* 0½*d.*), and the tyres alone from 14·5 yen to 18 yen a pair (the diameter of the wheel is 42 inches). It is estimated that these tyres will last two years, but as they have only been in use a short time it is impossible to judge. On the other hand British imported tyres used by the brokers have lasted for over ten years ; similar tyres now cost 30 yen. Most of the tyres now coming into use are manufactured locally, though some few are imported. All the Japanese firms making tyres also manufacture rubber soles for the "tabi" or blue socks which the rikisha men wear ; they also make rubber balls and various other rubber goods. There are many small factories with from 10 to 15 hands, especially in Osaka. The principal consumers of rubber are the electric wire works, which manufacture articles for the use of the army and navy. Two companies are installing plants for making waterproofs for the navy. Japan import supplies of crude rubber from the Straits Settlements, the Dutch East Indies, the United Kingdom and America. Plantations have been made in Formosa, and wild rubber is also found there. —*Board of Trade Journal*, March 31.